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ABSTRACT

Planners and presenters at this conference organized by CAUSE, the professional association of the development, use and management of information technology in higher education, all focused on giving participants practical "handles" for grasping the momentum of the current information era. An opening section provides summaries of the conference's general sessions including the keynote address, the ELITE Award and CAUSE/EFFECT Contributor of the Year luncheons, the Wednesday and Thursday general sessions, and the closing Current Issues Forum. A section on the professional program summarizes many of the sessions from the Current Issues discussion groups, Poster Sessions, Constituent Group meetings, and a news conference offering. Following this are the 49 presentations delivered at the conference, printed in full and grouped into the following eight "tracks": (1) leadership in strategic planning and management; (2) managing and working with shrinking resources; (3) changing responsibilities of personnel in information technology; (4) setting policies and standards for user support; (5) managing networking and telecommunications; (6) delivering information technology to executives; (7) how information technology fits into teaching and learning; and (8) management challenges for distributed services. Concluding sections contain material from participating corporate sponsors, information on a post-conference "Ask the Experts" session, a pictorial review of the conference, and a conference evaluation summary. (JB)

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CAUSE

Grasping the Momentum of the Information Age

Proceedings of the 1992 CAUSE Annual Conference

December 1 – 4, 1992
The Loews Anatole Hotel
Dallas, Texas

HE 026 295

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CAUSE, the association for managing and using information technology in higher education, helps colleges and universities strengthen and improve their computing, communications, and information services, both academic and administrative. The association also helps individual members develop as professionals in the field of higher education computing and information technology.

CAUSE was organized as a volunteer association in 1962 and incorporated in 1971 with twenty-five charter member institutions. In the same year the CAUSE office opened in Boulder, Colorado, with a professional staff to serve the membership. Today the association serves more than 2,800 member representatives from nearly 1,050 campuses representing over 700 colleges and universities, and 59 corporate members.

CAUSE provides member institutions with many services to increase the effectiveness of their computing environments, including:

- the CAUSE Exchange Library, a clearinghouse for documents and publications made available by members through CAUSE;
- the Institution Database (ID) Service, which provides to members information about typical computing practices among peer institutions from a database of member institution profiles;
- association publications, including a bi-monthly newsletter, *CAUSE Information*; a quarterly newsletter, *Manage IT;* the professional magazine, *CAUSE/EFFECT*; and a professional paper series;
- workshops, seminars, and institutes;
- a rapidly expanding program of electronic access to association information; and
- the CAUSE annual conference.

We encourage you to use CAUSE to support your own efforts to strengthen your institution's management and educational capabilities through the effective use of computing and information technology.

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INTRODUCTION

by David Ernst
CAUSE92 Chair

With the celebration of its 21st birthday in 1992, CAUSE is moving into the "age of majority"—along with the technologies we work with and the organizations we support. The momentum of the past two decades is creating fundamental changes in the uses of information technology in our colleges and universities, and in the infrastructures which enable new access to information. The momentum keeps building for simpler, instantaneous, and ubiquitous access to information; for cost controls; for integration of the traditionally independent protocols and applications.

Planners and presenters at CAUSE92 all focused on giving conferees practical help—"handles" by which they could really "grasp the momentum of the information age." This theme permeated the program, from Nicholas Negroponte's general-session observations about the potential of computing and networks to support a lifestyle in which the division between work and play disappears, to Carole Barone's colorful multimedia challenge to re-interpret management rules, to Skip Ross's portrayal of the process of developing large-scale client-server systems under corporate production deadlines. At the humor-filled Current Issues Forum on Friday, Richard Katz and John Sack discussed organizational, technological, and economic trends of the decade. And 48 concurrent track presentations, 16 corporate presentations (plus a one-of-a-kind Friday afternoon technology program at Dallas's INFOMART), workshops, and current issues and special sessions provided a range of opportunities for learning and sharing.

The Program Committee restructured this year's schedule to emphasize what many feel is the most important feature of a conference, colleague interaction. Poster sessions, which were popular at CAUSE91 for their relaxed format, were brought back this year, and a new type of session was introduced which allowed multiple campuses to give their perspectives on common experiences. This new format allowed participants to talk with a number of colleague "experts" simultaneously.

The CAUSE conference always provides a venue for recognizing significant contributions to the association and our profession. Among those honored this year were Bernie Gleason for his innovative, effective use of information technology at Boston College, and Gerry Bernbom for an outstanding *CAUSE/EFFECT* article on data administration—Gleason through the third annual CAUSE *ELITE* Award, and Bernbom through the 1992 *CAUSE/EFFECT* Contributor of the Year Award. Both programs were sponsored this year by Systems and Computer Technology Corporation. A new award program was announced at CAUSE92: the CAUSE Award for Excellence in Campus Networking, sponsored by Novell.

In keeping with CAUSE conference tradition, corporate support made possible some very high quality communication, education, and entertainment components of CAUSE92. Communications Central, messaging kiosks, a daily newspaper, Print-on-Demand conference papers, and a first-time-ever photo directory of conferees contributed greatly to the congenial atmosphere of this conference and to the ease of colleague networking. A fun run, tennis and golf tournaments, refreshment breaks, hospitality suites, and a popular corporation exhibit area were all sponsored by generous corporate contributions. The Digital-sponsored Tuesday-night registration reception brought "DEC-ades of Progress" to life through an old-time saloon which opened into a modern-era disco. Thursday night, Hewlett-Packard hosted a "Round-up at the HP Corral" which brought unprecedented numbers of conferees onto the dance floor.

These proceedings make available to the record 1,410 CAUSE92 conferees—and to professionals who were unable to come to Dallas—an in-depth look at the excellent conference offerings. Note that recordings of the presentations are available on cassette tape (see order form on the last page), and that many papers are also available via the Internet (see copyright page).

On a personal note, chairing CAUSE 92 has been one of the most fulfilling assignments of my professional life. The tremendous support from the CAUSE staff, the wonderful facility, the spontaneity and enthusiasm of the participants, and the extremely high quality of the presentations all worked together to make CAUSE's 21st birthday one we'll remember for years to come. While this volume of proceedings is merely a static reflection of what was a very dynamic and tangible few days, it is the best we can do short of reliving the reality. I hope you will enjoy and use this account of how we "grasped the momentum of the information age" in Dallas for a handful of December days in 1992. ❧

ACKNOWLEDGMENTS

The success of the CAUSE National Conference is due to the contributions of many people and supporting organizations, several of whom deserve special attention:

▲ The CAUSE92 Program Committee

This committee, under the leadership of chair David J. Ernst and vice chair David W. Koehler, dedicated countless hours to produce an outstanding program at CAUSE92. CAUSE gratefully acknowledges their enthusiasm, time, and efforts, and the generous support of their institutions.

Left to right, front row,: Russell S. Vaught, Pennsylvania State University; Linda A. Chiappe, Emory University; Sharon R. Setterlind, Eckerd College; Margaret M. DuFala, Florida Institute of Technology. Second row: David J. Ernst, University of California/San Francisco; Louise S. Lee, Barry University; Barbara B. Wolfe, Southern Methodist University. Third row: David W. Koehler, Cornell University; Clifford Woodruff, Tulane University; Margaret Drake, University of Texas Health Sciences Center at San Antonio; Steven W. Gilbert, EDUCOM Liaison. Not pictured: Larry D. Conrad, Arizona State University, and Thomas W. West, California State University System Office.

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▲ 1992 CAUSE Board of Directors

Seated, left to right: Geraldine MacDonald, SUNY/Binghamton; Secretary/Treasurer Diane J. Kent, University of British Columbia; Lee R. Alley, Arizona State University. Standing: Jane N. Ryland, CAUSE President; Gene T. Sherron, Florida State University; Marilyn A. McMillan, MIT; Charles Green, Houston Community College System; Chair Ronald Bleed, Maricopa Community Colleges; Vice Chair Kenneth C. Blythe, Pennsylvania State University; Leslie Maltz, Stevens Institute of Technology; ex officio member Carole A. Barone, University of California/Davis; James I. Penrod, California State University/Los Angeles, Thomas F. Moberg, Kenyon College.

The generous contributions of time, insight, and creative energy of the CAUSE Board of Directors are gratefully acknowledged and appreciated.

Retiring from the CAUSE Board during this conference were: Lee R. Alley of Arizona State University; Carole Barone of the University of California at Davis, who served in an *ex officio* capacity as immediate past chair; Kenneth C. Blythe of Pennsylvania State University, 1992 vice chair; and Diane J. Kent of the University of British Columbia, 1992 secretary/treasurer.

1993 Board Chair Leslie Maltz presents 1992 Chair Ron Bleed with a monogrammed briefcase in appreciation of his service, as she assumes office during the CAUSE Annual Business Meeting in Dallas.

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▲ CAUSE Member Committees

Neither the conference nor the other association activities could continue without the contributions of the seven creative and active CAUSE Member Committees. CAUSE appreciates the time and energy contributed by the volunteers who carry out the duties of these committees.

The many people who supported the association in 1992 through participation on association committees were acknowledged during various occasions throughout CAUSE92. Plaques containing certificates of appreciation were given to the following retiring committee members:

Current Issues Committee
Fred H. Harris, University of Tennessee
Thomas W. West, California State University System Office

Editorial Committee
Anita S. Better, Hunter College/CUNY
C. Edward Mathay, Marquette University
John D. Dayhoff, Duke University

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Louise S. Lee, Barry University
Sharon R. Setterlind, Eckerd College
Russell S. Vaught, Pennsylvania State University
Thomas W. West, California State University System Office
Barbara B. Wolfe, Southern Methodist University
Clifford Woodruff, Tulane University

Recognition Committee
Elliott J. Haugen, St. Louis University
Donald E. Heller, MIT

▲ Corporate Contributions

CAUSE thanks all those corporations who set up exhibits, gave corporate presentations, and provided hospitality on Wednesday evening. Their contributions add an enormously valuable dimension to the conference experience. Special thanks go to:

APPLE COMPUTER, INC.—for sponsorship of the conference information and messaging system; for co-sponsorship of the conference newspaper, Print-on-Demand conference papers, and the CAUSE92 picture directory; and for support of CAUSE Communications Central, on-site conference nametag production, speaker technology, and multimedia effects for Carole Barone's general session presentation.

DALLAS COMMUNITY COLLEGE—for videotaping seminar sessions.

DATATEL—for co-sponsorship of CAUSE92 tote bags.

DIGITAL EQUIPMENT CORPORATION—for sponsorship of the CAUSE92 Fun Run and the Registration Reception, and for co-sponsorship of CAUSE92 tote bags.

EASTMAN KODAK—for co-sponsorship of Print-on-Demand conference papers and the CAUSE92 picture directory, and for contributing all film for conference pictures.

FARALLON COMPUTING—for support of the CAUSENet system.

HEWLETT-PACKARD COMPANY—for sponsorship of the general-session speaker, Wallace A. Ross; the CAUSE92 Banquet; and support of CAUSE Communications Central.

HITACHI DATA SYSTEMS—for providing pencils for registration packets.

IBM CORPORATION—for speaker support and for support of CAUSE Communications Central.

KPMG PEAT MARWICK—for sponsorship of the CAUSE92 Tennis Tournament.

PERIPHONICS—for providing tablets for registration packets.

RICE UNIVERSITY and SESQUINET—for support of CAUSENet

SOFTWARE AG—for contribution of Justin Boots for the CAUSE92 Closing Social drawing.

SOUTHWESTERN BELL—for co-sponsorship of CAUSENet T1 line.

SPALDING CORPORATION—for providing a sleeve of golf balls for each participant in the CAUSE92 Golf Tournament.

SYSTEMS & COMPUTER TECHNOLOGY CORPORATION—for sponsorship of the CAUSE92 Golf Tournament, the CAUSE/EFFECT Contributor of the Year Award program, and the CAUSE Exemplary Leadership and Information Technology Excellence (ELITE) Award program.

XEROX CORPORATION—for co-sponsorship of the conference newspaper, and for support of CAUSE Communications Central.

GENERAL SESSIONS

CAUSE92 general session presentations challenged conferees to stay open to adopting rapidly changing perspectives of the future of information technology.

On Wednesday morning, Nicholas Negroponte, director of the Media Lab at MIT, offered conferees a vision of the future—computing that will be as unnoticed and essential as the air we breathe.

On Thursday, Carole Barone, associate vice chancellor for information technology at the University of Californai/Davis and chair of the 1991 CAUSE Board of Directors, gave an engaging and humorous presentation of the importance of being open to and encouraging change in managing IT organizations.

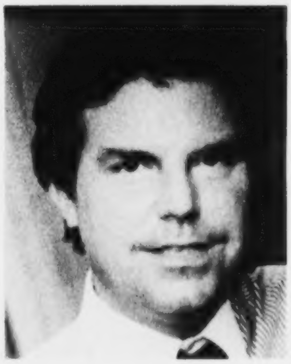
Wallace Ross, Hewlett Packard's Group Information Technology Manager, on Friday morning presented a detailed account of his company's rapid transition to a world-wide client-server architecture.

Friday's closing session, the Current Issues Forum, brought together Richard Katz, special assistant to the associate vice president for information systems and administrative services at the University of California; John Sack, Jr., Director of Stanford University's Data Center Libraries and Information Resources; and David Ernst, CAUSE92 Program Committee chair and assistant vice chancellor for information technology services at the University of California/San Francisco, to participate in a humor-filled Current Issues Forum on the organizational, technological, and economic trends of IT in the 90s.

Other sessions included a luncheon presentation of the Exemplary Leadership and Information Technology Excellence *(ELITE)* Award on Wednesday, the *CAUSE/EFFECT* Contributor of the Year award ceremony at Thursday's luncheon, and the annual business meeting on Friday morning.

WEDNESDAY MORNING KEYNOTE ADDRESS

"When Computing Becomes Like Air"

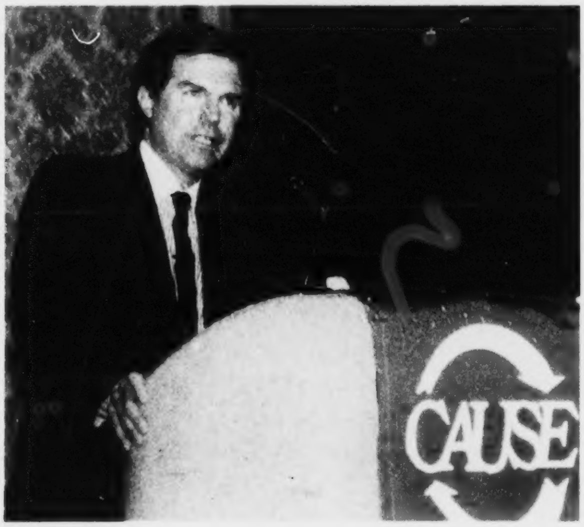


Nicholas Negroponte

Director of the Media Laboratory, MIT

Nicholas Negroponte predicts that the campus will be the first place where computing becomes like air: "noticeable only when you don't have it; otherwise utterly taken for granted." He explored three dominant trends in higher education information technology: the vanishing desktop, the reversal of roles between wires and wireless transmission, and the role of delegation vs. direct manipulation at the interface.

Negroponte said that if we're to make computing as ubiquitous as many of us envision, we will have to change our computing metaphor. Forget the "ease of use" paradigm, and think "delegation," to an agent that is expert at both retrieving information from a body of knowledge and knowing one's personal interests. This may be a good secretary, or it can be computing technology that is truly personalized.



He envisions the demise of the desktop as a primary place for computing, and the emergence of mobile, wristwatch-type computing. Air and ether are trading places with ground and wire for communication, he says. Cables are carrying more TV, while phones are moving forward to radio frequency. Negroponte predicted that the important distinction is whether you are trying to communicate with things that move. "The issue is not computing networks, but lifestyle." Negroponte believes that ubiquitous, mobile, truly personalized computing will allow a peripatetic lifestyle in which the division between work and play disappears.

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ELITE AWARD LUNCHEON

Left to right: 1992 CAUSE Board Chair Ron Bleed, Bernie Gleason, and Mike Emmi, president of award sponsor Systems & Computer Technology Corporation.

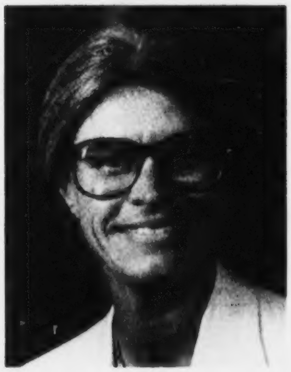
Bernard W. Gleason, Jr., executive director of information technology at Boston College, was awarded the CAUSE *ELITE* Award for Exemplary Leadership and Information Technology Excellence at CAUSE92's Wednesday luncheon.

The ceremony included a video presentation that demonstrated Gleason's sense of vision and his innovative use of information technology, and included comments from his colleagues, who see him as being "filled with anticipation" and possessing credibility and an ability to stay ahead of the learning curve. In his acceptance remarks, Gleason stressed his commitment to supportive management, and to the changing role of the CIO as "Chief Integration Officer—integrating services and the people who provide those services."

THURSDAY GENERAL SESSION

"New Interpretations of Old Rules...or if the ocean is on the right you are headed north"

Carole Barone
Associate Vice Chancellor for Information Technology
University of California/Davis



The jaunty strains of "Buttons and Bows" opened Carole Barone's Thursday morning general session presentation—a thoughtful talk colored with imaginative, humorous multi-media effects. Barone told of her own experience with paradigm shift when she recently transferred her 48 years of experience on the East Coast to a new home on the West Coast. Describing change as "pervasive, fundamental, and unremitting," she stressed its importance as the source of a new context, leading to new values and new management strategies. Barone asserted that, "We must remain flexible and open to change in order to survive."

She noted that changes in the societal context have brought more diversity, a dispersed workforce, a greater dependence on networks and communications, and democratization of IT as the virtual office changes the way we work. She offered twelve rules for management in the context of the 90s, among them: "Adversity breeds opportunity," "Ignore the old rules," and "Learn what's best for *them*."

Barone also emphasized the importance of professional development for managers, and challenged CAUSE to develop an integrated, comprehensive, multi-faceted, multi-year development program. "Remember to focus on where you're going, not where you came from," Barone concluded. "You'll never get lost." *(Video tapes of Carole Barone's talk are available through the CAUSE Exchange Library. The text of her speech has been printed in the Spring 93 issue of CAUSE/EFFECT.)*

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THURSDAY LUNCHEON

CAUSE/EFFECT CONTRIBUTOR OF THE YEAR

The winner of the 1992 *CAUSE/EFFECT* Contributor of the Year Award, Gerry Bernbom (left), assistant director of data administration and access at Indiana University, was introduced at the Thursday luncheon. The winning article, "Data Administration and Distributed Data Processing," appeared in the Winter 1991 issue of *CAUSE/EFFECT*. It focuses attention on the technology of distributed data processing, its capabilities, and its limitations with respect to providing a logically unified structure for an institution's data resources. The article shows data administration as an ally and enabler in support of distributed data processing.

Pictured with Bernbom is Mike Chamberlain, president of SCT's Software Technology Division. The Contributor of the Year Award has been sponsored since 1982 by Systems & Computer Technology Corporation. In addition to his plaque, Bernbom received a $500 stipend and a complimentary registration to the conference.

CAUSE REACHES A MILESTONE

CAUSE92 gave Member Liaison Committee Chair Bill Enright (left) of the University of Western Ontario a chance to personally mark the addition of the 1,000th CAUSE member campus. Shown at right is Al Saber, vice president for information technology at Friends University in Wichita, Kansas, accepting the commemorative plaque for his university.

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THURSDAY LUNCHEON

1993 CAUSE Board of Directors. *Seated, left to right: Secretary/Treasurer James I. Penrod, California State University/Los Angeles; Chair Leslie Maltz, Stevens Institute of Technology; Vice Chair Thomas F. Moberg, Kenyon College. Standing: Jane N. Ryland, CAUSE President; Gene T. Sherron, Florida State University;Marilyn A. McMillan, MIT; Charles Green, Houston Community College System; Past Chair Ron Bleed, Maricopa Community Colleges; Linda A. Chiappe, Emory University; Geraldine MacDonald, SUNY/Binghamton; Kenneth G. Pollock, Wright State University; Brian L. Hawkins, Brown University; David J. Ernst, University of California/San Francisco.*

At left are the CAUSE Board officers for 1993. *Seated, left to right: Secretary/Treasurer James I. Penrod, California State University/Los Angeles, and Vice Chair Thomas F. Moberg, Kenyon College. Standing: Past Chair Ron Bleed, Maricopa Community Colleges, and 1993 Chair Leslie Maltz, Stevens Institute of Technology.*

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FRIDAY MORNING GENERAL SESSION

"MIGRATING TO A CLIENT-SERVER ARCHITECTURE—A PRACTITIONER'S VIEW"

Wallace A. Ross
Group Information Technology Manager
Hewlett-Packard

In the Friday morning general session, Wallace (Skip) Ross, a 12-year veteran in his job, described the process of Hewlett-Packard's development of a client-server approach to the company's worldwide customer support network. Although the scale of this operation is larger than any higher education institution will face ($2.5 billion in business and over 17,000 employees), Ross made it clear that the process involved in the rapid development and implementation of such a system under corporate production deadlines presents the same challenges faced in higher education: How do you migrate from your legacy systems? What architectural structure will work best? What are the people implications?

CURRENT ISSUES FORUM

"HOW DO WE GRASP THE MOMENTUM?—STAYING ON THE RIGHT TRACK WITHOUT BEING RUN OVER"

David J. Ernst
Assistant Vice Chancellor, ITS
University of California/San Francisco

Richard N. Katz
Special Assistant to Associate Vice President—Information Systems & Administrative Services
University of California

John R. Sack, Jr.
Director, Stanford Data Center
Libraries and Information Resources
Stanford University

In the Current Issues Forum, the closing forum of CAUSE92, panelists tackled the challenge of harnessing the forces of change in higher education and the outside world to benefit our institutions. David J. Ernst of the University of California/San Francisco and CAUSE92 program committee chair; Richard N. Katz, of the University of California Office of the President; and John R. Sack, Jr., of Stanford University gave a pointed, humor-filled look at the topic. They addressed three major forces of change in the 90s:

Organizational—The trend to more autonomy and responsibility at the working level is creating a demand for delivery of timely, accurate information to the user.

Technological—The trend to "client-server" and "cooperative processing" architecture on campus is a response to this "populist" movement, and promises to make local autonomy a working reality at more and more institutions.

Economic—A potentially destructive force, the present economic downturn must be dealt with constructively to maintain the momentum of positive change for institutions of higher education.

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PROFESSIONAL PROGRAM

CAUSE92 brought together over 1,400 conferees from around the world for nearly 50 professional presentations in eight tracks at the Loews Anatole Hotel in Dallas, Texas. Aside from these track presentations, conferees could choose from Current Issues discussion groups, Poster Sessions, Constituent Group meetings, and a new conference offering, Campus Perspectives.

This section includes summaries of many of these sessions, followed by the text of papers presented in the concurrent track sessions.

CAUSE thanks all those who organized and led sessions, especially those on "standby" status who agreed to present their papers if a presenter had to cancel. One of these papers was presented, and one standby paper which was not presented at CAUSE92 is included here.

Current Issues Sessions

Eight Current Issues Sessions provided informal opportunities for conferees to meet and exchange ideas on topics of special interest or concern. The topics were chosen from issues that have been of interest to the profession in the past year.

Building the Network Infrastructure in Community Colleges: Why and How
Moderator: Jan Baltzer, Maricopa Community Colleges

Building the Network Infrastructure in Small Colleges: Why and How
Moderator: Jeffrey Noyes, Mercer University

Computing and Library Organizations: Impact of Integrating Technologies
Moderator: Anne Woodsworth, Long Island University

"Downsizing" Academic Computing
Moderators: William (Skip) Brand, Arizona State University
Bill Lewis, Arizona State University

Implementing and Managing a Campus-Wide Information System (CWIS)
Moderator: James Sweeton, University of Michigan

Network Security and Ethics
Moderator: Tim McGovern, MIT

Network-Based Publishing
Moderator: Steve King, Harvard University

Reaching Your President About the Value of IT
Moderator: Carol Twigg, SUNY Empire State College

BUILDING THE NETWORK INFRASTRUCTURE IN COMMUNITY COLLEGES: WHY AND HOW

Discussion Leader:
Jan Baltzer, Maricopa Community Colleges

There were twelve (12) individuals who attended this session on building network infrastructure in community colleges. This was an energetic and lively session with a great deal of information exchanged among the participants. The moderator opened the session with summary statements regarding the trend, in community colleges, toward more collaborative, student-centered learning and more sharing of information and resources across the college.

Following the opening comments, the participants discussed the following issues regarding networking on community college campuses.

- There is an entire vocabulary of networking that is virtually unknown by the majority of technical and managerial people on our college campuses. Without a knowledge of what is possible and how to discuss what is possible, it is difficult to make major inroads with networking technology.

- Networking our information technology resources on campus and between campuses is essential because of increased numbers of remote sites within a college, increased numbers of distributed academic labs on campus, software licensing issues, increased usage and dependence upon electronic mail, and increasing demand for access to data resources located at other institutions throughout the U.S. and abroad.

- Many institutions with older facilities do not have the cable plant infrastructure in place to make networking possible. This means that networking computers is more costly at these locations at a time when funds are decreasing. The lack of overall cable plant documentation and standards increases this problem.

- There is an enormous training agenda associated with information technology networks in higher education. Users must be trained to use the networks efficiently and effectively. Technical professionals must be trained to design, install and maintain networks and network-based applications with multi-vendor and multi-platform flavors.

- There is no "cookie cutter" approach to the design and management of information technology networks. Therefore, each institution must assess its own needs and technology levels before a network can be designed specifically for that institution.

- The basis of solid network management is solid network design. A network that is not thoroughly thought out from the beginning with an overall architecture established for expansion and growth, cannot be well managed as technology at the desktop and in the computing center changes; and it, inevitably, will change.

Building the Network Infrastructure in Small Colleges: Why and How

Moderator:
Jeffrey W. Noyes, Mercer University, Macon, Georgia

This session focused on the practical needs of I.T. managers in small colleges while trying to build networks on their campuses. Each attendee introduced him or herself and spent a few minutes describing their campus and the particular problems that they faced regarding networking at the moment. There were 13 private and 2 public institutions represented, and most schools had an enrollment of under 3,100 students. Almost half already have Bitnet nodes installed on their campuses.

The moderator then continued the introduction of the topic and presented two brief case studies as examples of different approaches to various aspects of building a network on a small college campus. The first was the "non-planned" approach. Very little formal planning with no long range planning or budgeting in the college at all. Building a network in this environment requires the incremental method. Keep your own long-range plan in your head and implement it a little at a time using whatever opportunities present themselves. The second case study was in a college where a large amount of money was made available by the Board of Trustees to enhance the overall I.T. program. In this case, all of the normal, formal planning techniques should be used, including use of outside consultants.

Lively discussion then followed on these topics:

- Funding sources and methods, including the NSF Network Startup Grant Program
- Marketing to faculty.
- Network architecture and topology.
- Cabling problems and solutions
- Finding out what others are doing.

Overall this was a very good and highly interactive Current Issues session, indicating that we truly did have a "current issue" to discuss. A great deal of practical information was exchanged. Several discussions continued after the allotted time had expired. Several of the attendees requested similar sessions in future CAUSE conferences and asked that the Current Issues sessions be longer. Also several attendees requested more sessions for small colleges and that those sessions be scheduled so as not to conflict with other popular sessions (small colleges typically can afford to send only one attendee, so scheduling which sessions to attend can be a very difficult problem).

CURRENT ISSUES SESSION: Thursday, December 3, 1992

Computing and Library Organizations: Impact of Integrating Technologies

Moderated by Anne Woodsworth

Topics of interest in this group included: how well do merged organizations work; how to knit together two recently "married" organizations; the roles of various groups, including where academic computing user consultants and registrars fit best; identification of successful and unsuccessful models; how best to organize multi-campus academic computing and library organizations. Is it better, for example, to have a centralized library system operated by librarians or to bring them into the CIO's organization. Some participants were debating whether or not to create a CIO position. The group felt that the trend was still to create CIO positions, but that in part both the creation of the position, and who becomes the CIO is definitely influenced by personal preferences of senior officers.

Most of the discussion centered around cultural differences since they were felt to account for 80 percent of the problems between the two organizations. In addition, libraries themselves are also divided into public services and technologically based operations. Librarians entering merged organizations fear erosion of their budgets and their faculty status. On the other hand, librarians are viewed as having more credibility when funds are needed. It was noted that librarians have more readily become systems oriented than computing staff have become library/information oriented.

Other concerns mentioned were the inequities in salaries, and education. It was agreed that Carole Barone was right in her address -- that reward systems would have to be altered to be based on outcomes, not on what is done, or education, or other traditional factors. The moderator mentioned that a report on a recent study of jobs in libraries and computing centers would be published by CAUSE as a professional paper in 1993 and that it pointed to the same conclusion.

Solutions suggested by participants included having a director of library systems be part of, or reporting (jointly perhaps) to the computing organization. Failure is assured if there is a hostile take-over. Success in merging computing and library organizations was felt to be more likely if there were more than just two organizations involved. Another suggestion was to pick some problems/issues for the two to work on that are assured of successful outcome. Finally, it was felt to be important that the person heading the merged organization be perceived to be without bias toward one or the other organization.

There were no resolutions for CAUSE from this session apart from agreement that there is continuing interest in this topic among conference participants. Of fifteen people in the session, several were CIOs, several were librarians, and the rest from administrative and academic computing organizations.

"Downsizing" Academic Computing

William (Skip) Brand
Information Technology Analyst
Arizona State University

Bill Lewis
Interim Director
Academic & Communications Technology

Twenty five people attended this current issues session and there was spirited discussion. Participants discussed numerous academic computing areas that are, and will be considered for downsizing efforts. Unanimous agreement was meet about the continued tightening of budgets and fiscal woes on our respective campuses. The pressure building from increasing demands for information technology support coupled with decreasing funding for hardware, software, and staff has lead to strategic downsizing of academic computing.

The three main motivations for downsizing academic computing are economic, technical, and organizational. These three motivations are pressuring information technology organizations to use client/server-based downsizing to decrease hardware purchases; and at a personnel level are requiring information technology organizations to distribute staff to colleges and departments for academic support. From shared experiences and perspectives many solutions for downsizing academic computing were debated, challenged, and discussed.

The session determined that downsizing means many different things to different information technology professionals. The discussion emphasized two issues in downsizing in the 90s. The first issue was downsizing technologies and architectures, which includes transitions and migrations from supercomputing and mainframe platforms to client/server computing and open systems. Many successful examples, helpful advice, and pitfalls to be avoided were alluded to when downsizing to a client/server academic computing environment. The second issue was managing the downsized environment, which meant for many universities and colleges to downsize the centralized academic computing consulting staff. Several participants have had much success downsizing their centralized computing support staff and distributing staff out in the colleges and departments.

There was agreement about the need for more discussions concerning downsizing efforts in academic and administrative computing. To meet these needs an electronic round table called "Downsizing Academic Computing" was started at Arizona State University. To join this electronic round table contact William (Skip) Brand at IDWJB@ASUACAD.

Implementing and Managing a Campus-Wide Information System

Current Issues Session
Thursday, 3 December 1992

James C. Sweeton
GOpherBLUE Project Manager
University of Michigan
Ann Arbor, MI

Les Lloyd
Director, Computing Services
Lafayette College
Easton, PA

An overflow crowd heard two short presentations on Campus-Wide Information Systems (CWIS) implementations, and then engaged in a lively discussion of the potential and pitfalls of CWIS.

The session moderator, Jim Sweeton, briefly discussed the scope of the GOpherBLUE Project at the University of Michigan--the perspective of a large, public University. Les Lloyd then gave an overview of implementing and managing a CWIS at a small, private college. After the two five-minute talks, the session was open to questions and comments from the audience. Many interesting issues and opinions were expressed, and from the moderator's perspective, the session was lively, very useful, and too short!

Current Issues Session on Network Security & Ethics

Thursday, December 3, 1992

Discussion Leader: Tim McGovern, MIT
Manager, Development
Distributed Computing & Network Services

Approximately 60 people attended this session, and the interaction was brisk and informative. The sense of those in attendance was that the CAUSE board should seriously consider placing special emphasis on the topic of Security and Ethics in Computing when assembling the CAUSE93 program.

To set the stage, the moderator reviewed some of the topics that have been making the news of late:

- Hackers
- Software Piracy
- Electronic Harassment
- Pornography on the Internet
- Email and Privacy
- Service denial attacks (Crackers)
- Academic dishonesty
- Worms, viruses & Trojan horses,
- and many, many more.

The moderator then tried to establish the difference between concerns that might arise from the Network Security viewpoint, and those that might arise from the Network (or Computing) Ethics viewpoint, because they are significantly different.

A sampling of Network Security concerns might include:

- Passwords
- Cryptography
- Surveillance
- Restrictions on Use
- Monitoring Use
- Invasion of Privacy
- Legal Issues
- and many, many more.

On the other hand, Network (and Computing) Ethics is concerned with:

- Moral Obligations
- Values
- Responsibilities (on all sides)
- World-views, open vs. closed, etc.
- and many, many more.

Using these thoughts as a base, the moderator then accepted suggestions from the meeting attendees for THEIR concerns, and REAL-LIFE EXPERIENCES. We listed eight different suggestions, and discussed about half of them before we ran out of time (each of these could easily constitute an entire paper for future CAUSE programs). The suggestions we received were:

- How to proceed if your school refuses to have an ethics policy
- How to migrate from 327x access to Internet (TCP/IP) access
- How to work with all types of auditors in this realm
- How to make Unix more secure
- How to support/limit Free Speech issues.
- How to support K12 Access
- How to provide secure dial-up access to network resources
- How to assess institutional liability

CAUSE Current Issues Session

Thursday, December 3, 1992 5-6pm

Topic: **Network-Based Publishing**
Moderator: Stephen King, Associate Director OIT, Harvard University

The session included sixteen CAUSE attendees and was structured into two parts. The first third of the program was a presentation of Harvard's experiences in 1992. The second and major segment of the session was a discussion of the technology developments and management challenges of network-based publishing. Overall, the session included an excellent cross-section of interests and responsibilities and some healthy interchange.

The Harvard presentation began with the scope and case for network-based publishing. The drivers for network print are both the electronic/digital world including Data Center output as well as the hard copy world of paper. The case is a transformation of the $3 billion higher education publishing market and a cost savings opportunity of 10% at Harvard. Examples of network-based publishing included custom course materials for English as a Second Language generated from digital libraries, HBS case reprints from the scan-store-print model, Core Curriculum course materials generated from hard-copy masters cleared through publishers, and a variety of administrative/academic publications submitted over the network from publication offices. Multiple vendor solutions including Xerox, Kodak and McGraw Hill were highlighted. Comments were offered on the service delivery, financial and organizational experience in the 1992 prototypes. The CUPID architecture for network print, a project sponsored by CNI, was introduced and copies made available to attendees.

The first area of discussion reviewed the status of network-based publishing at other institutions and the state of technology in the industry. Most organizations are in the planning stage and keen interest exists for the opportunity to lower the cost of books to students. A number of technical issues were raised including content addressibility of documents, support for data formats beyond Postscript and Group III/IV image including SGML, and storage media such as CD-ROM and photo CD. The next generation will bring a set of experiences which assume multi-media and electronic access. **One key issue identified is the changing preference for electronic view versus hard-copy read of documents.** The group was divided, but concerned overall about screen encoding and viewability. The CAROUSEL project recently reviewed at INTEROP was discussed.

The second dimension of the discussion on network-based publishing was the I/T management challenges. **From an organizational view network-based publishing is an intersection of computing, reprographic, publishing/printing and libraries.** A premise was offered that network-based publishing is an area for I/T leadership in the 1990's. The selling of the vision must address the potential benefits: cost savings, quality, service paradigms, etc. Debate exists over the organizational readiness for network-based publishing and what incentives are needed/appropriate for cultural change. Underlying the topic of network-based publishing is a major issue of copyright. Recognition was given that service organizations including I/T will have to invest in staff retraining and business re-engineering. The investment costs and widespread availability of technology were voiced as concerns by the group. An interesting paradigm of advertising in publications was offered to defray costs.

The last session concluded with a brief discussion of what are possible next steps for CAUSE to forward the issue of network-based publishing. Two specific suggestions were offered:

1. Electronic publication of CAUSE publications and documents.
2. A plenary session that might bring into the perspectives of all parties from author to publisher to printer to I/T to consumer.

In conclusion, the moderator was struck by the varied perspectives which were encapsulated in the changing of the session title from network-based printing to network-based publishing.

REACHING YOUR PRESIDENT ABOUT THE VALUE OF IT

Discussion Leader:
Carol A. Twigg, SUNY Empire State College

The purpose of this session was to share stategies of how to convince presidents about the value of information technology as campuses prepare to enter the twenty-first century. The session attracted about 40 participants representing all sectors of higher education. The large number of attendees is indicative of the high level of interest in this topic among CAUSE members, but the size of the group made it difficult to do more than identify and elaborate the issues surrounding the topic from multiple perspectives and share several success stories. There was general agreement that this topic should be included as a central theme in future CAUSE programs.

Most participants viewed reaching their presidents as a problem needing to be solved; only a small number have been successful in this regard. Most people attended the session because they were seeking ideas about how to be more effective in persuading their presidents and others about the value of IT. All were especially concerned about the impact of tight budgets and competing campus priorities. The discussion emphasized the fact that administrators other than the chief executive officers need to be reached since frequently presidents listen and respond to campus constituencies rather than take the lead. Some of the issues and problems we identified are:

- presidents who "won't touch a computer"
- presidents who have a low level of technological knowledge
- lack of continuity due to frequent leadership changes (i,e., as soon as you convince one president, you get a new one!)
- lack of strategic planning on campus in general; consequently, lack of inclusion of the role of IT in planning

A number of specific ideas and strategies emerged in the discussion, all of which centered around the following themes:

- Communicate, communicate, communicate. You need to have a conscious and deliberate plan to *sell* the value of IT.

- Avoid tech talk. "Network" is jargon to most campus folks. Speak the language of the users and help them see how the network can solve their problems or meet their needs.

- Adapt your strategy to your president's style: some need to be personally persuaded; others respond to various campus constituencies (e.g., champions at the vice presidential level, key faculty leaders)

Two excellent articles on this topic recently appeared in *Beyond Computing*: "Selling IT is Part of the Job" (May/June 1992) and "Xerox's Visionary CIO" (October/November 1992). Those interested may contact the discussion leader for copies.

Campus Perspectives

Campus Perspectives Sessions were new at CAUSE92. At these sessions, two or more college and university campuses focused on common topics in IT management. The papers that follow are summaries of their talks.

Client/Server Environments
Steve Franzkowiak, Metro State College
Cathy Smith, Indiana University

Departmental Partnerships
Kitty Bridges, University of Michigan
Bob Cermak and Ron Dawe, Colorado State University

Disaster Recovery
Albert LeDuc and Deborah Stedman, Miami-Dade Community College
M. Lewis Temares, University of Miami

Involving Internal and External Customers
Donald E. Harris, University of Maryland/Baltimore
Jeff Hunter, North Carolina State University

Total Quality Management
Jane S. Fox, University of Wisconsin/Madison
Mark Luker, University of Wisconsin/Madison
(formerly of University of Minnesota/Duluth)
Paul Morris, Tufts University
Gloria Thiele, University of Michigan

Z39.50 Information and Retrieval Protocol
Cliff Lynch, University of California
Eric Ferrin, Penn State University

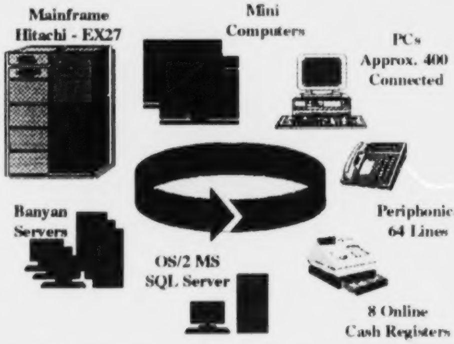
Campus Perspective
Client Server Architecture

Metropolitan State College of Denver
Steven Franzkowiak

Information Technology - Application Services Manager

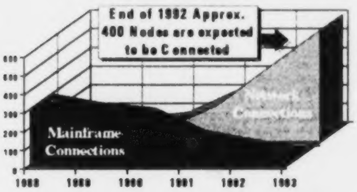
Over the past three years, Metropolitan State College of Denver has undergone a significant transition to a campus wide Banyan Vines networked environment in support of its business and academic administrative functions. In the summer of 1991 the College's IBM 4381 system was replaced with a Hitachi EX27 with three times the processing power and twice the disk storage. All mainframe direct connect users were switched to the network which provides 3270 access to the mainframe based administrative systems. In addition, every academic department is in the process of being placed onto the network with powerful desktop computing for department chairs, faculty and support staff.

To date approximately 400 nodes have been attached to the network with over 200 to be added in the future. This has resulted in many more individuals having access to computing technologies than ever before. Graphical based applications running on 386 PC's are now in wide spread use by staff and faculty. The business need to have access to institutional information and application systems has, and will continue, to escalate significantly. MSCD has entered into a WINDOWS world with all the expectations of Microsoft's **"Information at Your Finger Tips"**.



The role of Application Services and the portfolio of existing NATURAL/COBOL based information systems is changing in order to adapt to this new end user environment. It is imperative that application development occur at a quicker pace than ever before and provide greater data and systems integration. To meet these increased demands and set a development platform for the future, MSCD is working towards implementing the Client Server Model.

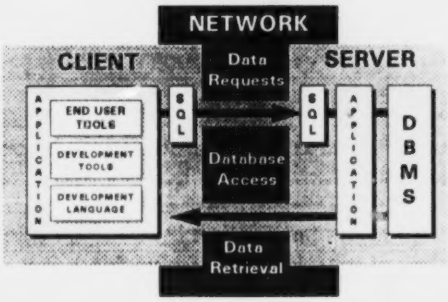
Migration from Mainframe Connections to Campus Wide Network



The pilot application currently under development is in the area of student degree planning and tracking. The database platform consists of Software AG's ADABAS and Microsoft's SQL Server. Application development tools are being evaluated, with Powersoft's PowerBuilder a leading contender. Object Oriented programming languages such as Symantec's ACTOR are being evaluated as well. Query tools such as Microsoft's database ACCESS along with EXCEL spreadsheet will provide the end user with abilities to extract and report information in ways currently not possible within our environment.

The Client Server environment should enable MSCD to realize the benefits of cost effective computing technologies in both hardware and software in addition to providing greater access to institutional information on a more timely basis. Application delivery time is expected to be reduced and yet provide higher quality information systems with increased capabilities.

Client Server Model



Campus Perspectives: Client/Server Environments

Restructuring for Distributed Computing at Indiana University
Cathy Smith Director, Program for Distributed Computing
Indiana University

I. **Institutional Profile**
Large public university; merged academic and administrative computing

II. **IU's Strategic Direction: Distributed Computing**
   A. Integrated personal computing environment
   B. Services delivered transparently to desktop computer
   C. Services presented through desktop computer interface
   D. Implemented via client/server cooperative processing paradigm
   E. Our distributed model includes and provides seamless interface to four network service domains:
      1. Personal
      2. Workgroup
      3. Campus/University
      4. Internet
   F. Why is this our strategic direction?
      1. "Desktop as portal" is best way to provide services from many sources
      2. Delivery through single, local, familiar point-and-click environment
      3. Leverages huge investments in desktop technologies
      4. Access to services remains the same
         - regardless of service location
         - regardless of user location
      5. Maximum utilization of computing resources
      6. True inter-vendor computing

III. **Building a Distributed Computing Environment (DCE)**
   A. Fundamental strategy: learn and grow over time
      1. We haven't done this before, so we need to learn by doing
      2. Two principles:
         - Modularity: individual services based on common protocols are developed and deployed over time with new services transparently "plugging into" the existing structure
         - Scalability: services are deployed according to deliberate schedule of user base expansion coinciding with our abilities to manage and support expansion
   B. Use of common, open, application-level and network protocols ("standards based")
   C. DCE has four components
      1. Network
         - Highspeed; ubiquitous
      2. Desktop computers
         - Mac, DOS/Windows, Unix/Motif

3. Server computers
   - TCP/IP and standard APIs
4. Services
   - Infrastructure
     - directory
     - authentication
     - distributed file system
     - time
     - distributed database
     - distributed output
     - user interface toolkits

   - End User
     - mail
     - campus wide information system
     - News
     - "Student Lockers"
     - conferencing
     - "Electronic Classrooms"
     - University Register
     - administrative applications
     - etc.......

IV. **Organizational Changes**

A. Cross-organizational group assembled -- Program for Distributed Computing (PDC)
   1. Mission: To architect and implement DCE infrastructure and generic services to support instruction, research and administrative services
   2. Designs and implements DCE elements
   3. Provides organization-wide focus, leadership and coordination of DCE efforts

B. Cross-organizational User Support Coordination Team
   1. Designs ands implements all support mechanisms for distributed services
   2. Includes PDC, consulting, training and documentation staff

C. People/Mindset Changes are Hardest and Slowest

V. **Some of Our Important Lessons**

A. This takes time!

B. This takes modest resources
   1. The network and desktop computers were already there
   2. Price/performance leaders are fairly inexpensive servers
   3. Much software in public domain or locally developed
   4. Aggressive licensing arrangements keep required commercial software affordable

C. Market skillfully
   1. Too much "hype" causes inordinate expectations
   2. Too little hype results in no adoption

D. Shoehorning distributed applications on lower end DOS systems is too painful - go directly to Windows!!

Campus Perspectives
Departmental Partnerships

Panelists:
Kitty Bridges, University of Michigan
Bob Cermak, Colorado State University
Ron Dawe, Colorado State University

The evolving fiscal and technical environment of these two campuses has become the basis for cooperative approaches to supporting college computing needs. Both of these research universities have developed innovative computing partnerships between college and university offices. Different funding and decision-making models are used in the two partnerships. At Colorado State University, the partnership focuses on developing and implementing end-user-oriented administrative applications, while at the University of Michigan, the partnership focuses on providing distributed computing and instructional technology support.

Both partnerships were created because of the belief that colleges have specialized computing needs which are better understood by the colleges than by central staff. In both cases, a need to share costs was an important motivation, but, more importantly, both partnerships were built upon a new willingness to share responsibilities, risks, and rewards.

At CSU the joint administrative development effort grew out of a strategic planning process that mandated a balanced computing environment and encouraged risk taking. Both partners are contributing to the development of a client/server front-end to existing mainframe applications. The College of Business is managing graduate student developers while Information Systems is supporting the software and hardware platform. The project evolved into a formal agreement among all of the colleges with each having defined roles.

At the University of Michigan, a major 5-part partnership was developed between the Information Technology Division (ITD), U-M's central computing organization and the College of Literature, Science and the Arts (LS&A), U-M's largest college. This partnership, whose funding comes from both organizations, provides resources for distributed computing support and instructional technology. Through the partnership, ITD staff provide UNIX system administration support and onsite consulting and training for LS&A departments, and instructional technology programming assistance to LS&A faculty. An additional part of the partnership provides funding for equipment upgrades for instructional faculty. Decisions on how the resources are allocated are made in a distributed fashion, with ITD and LS&A each having decision responsibility for different parts of the partnership. This partnership has allowed ITD to use its resources to provide exactly the services which LS&A needs while allowing LS&A to prioritize its needs and support its highest priorities.

Miami-Dade Community College

Albert L. LeDuc
Director, Computer Services

Deborah Stedman
Systems Analyst

On August 24, 1992, in the early morning, Hurricane Andrew struck the mostly suburban area of South Dade County, Florida. Andrew, the largest natural disaster in US history, provides an interesting case study for disaster planning and recovery. Although it is difficult to interpolate this experience, at Miami-Dade Community College several conclusions were reached:

1. A Disaster Plan is imperative, if only to provide a set of rules to go by so that preparation for an impending disaster can take place in an orderly fashion.

2. Information Technology areas are far better prepared to deal with preparation and aftermath than the rest of the organization. There can be some misunderstandings and tension as a result.

3. Most organizations do not understand the nature of their vulnerability to technology disruption, especially if high standards of service are the norm.

4. Rehearsal and practice, as well as follow-up, needs to be a matter of rigor and routine.

5. Communications during and after the disaster can be a very distinct problem.

6. Psychological effects of a large-scale disaster last for months, may reduce productivity, may cause work stress, and probably should be dealt with specifically and professionally.

As someone has said, Andrew was in a different category than most disasters that occupy the media. For people directly affected, it was more like a warfare disaster than a storm. The disaster area encompassed 300 square miles of area, caused as much as $30 billion of damage, and placed 450,000 residents in home and business crisis. Two campuses of Miami-Dade Community College were seriously affected. The Homestead Campus had portable classrooms destroyed; the Kendall Campus had one building (which was used as an evacuation shelter) seriously damaged. That campus was used as a shelter site, a food and water distribution site, and a bivouac site for Army and National Guard troops.

With the planned support of Dade County Public Schools, the M-DCC payrolls were processed on August 27. With additional support from vendors, the computer systems were brought back up on September 3. On September 8, the College opened for business as usual, and on September 14, classes started for the Fall Term, two weeks later than scheduled. But the long-term effects continue: 23% of the Computer Services staff had dwellings seriously damaged or destroyed. 20% suffered "moderate" damage, 37% sustained damage typical of a normal hurricane. The remaining 20% mostly lived outside the area.

Professionalism and responsibility clearly were the reasons we have been able to support College needs in these times.

SOUTH FLORIDA WILL NEVER BE THE SAME

University of Miami

Dr. Lewis Temares
VP & CIO for Information Resources

"No single thing could have done more to restore the confidence of the people than the fact they got their paychecks on time".

Dr. Carl Eisdorfer
Chairman, Department of Psychiatry

Hurricane Andrew, the greatest natural disaster in the United States, arrived on August 24 with winds up to 175 mph. At the University of Miami, 35 roofs, 800 windows and 3000 trees were damaged, broken or destroyed. Over 400 employees lost their homes and over 5000 reported claims in excess of $5000. Almost 5000 parents and students on campus for orientation day and the opening of the residential colleges for the Fall semester, rode out the storm in huddled hallways on the floors.

Immediately after Andrew calmed down, the recovery began. The Public Safety Director went to the President's house and, "crashing through the woods," brought him to campus. The people in the telecommunications building, computing center, residential colleges and other shelters on campus, like groundhogs, slowly came out and saw the campus in shadow. Roads were impassable and with little power or phone service in the county, food and supplies were threatened. The health of the people on campus would become a growing concern as facilities became over burdened.

Communications on campus never faltered except the buttons on the phones did not light nor did the ringers ring. Mobile phones were clogged, regular service was spotty and blue jeans and sneakers were joined by beepers as the dress code.

Briefly, here's what the University did:

.....Daily meetings were held by the President with administration, faculty, and staff to exchange information and make decisions.

.....A census of the University employees was begun. Within a week all but 400 were accounted for and after search parties were sent out, everyone was accounted for.

.....School was delayed 18 days.

.....Students were offered the opportunity to go back home and be reimbursed with credit to their Spring tuition.

As a whole, the University suffered up to $15 million damage, of which half is covered by insurance. FEMA has been asked to cover most of the remaining portion. We are looking at a $1 - 4 million problem this year, not including lost revenue. But, although a tremendous hardship, we will recover. "I was so proud of our associates," said President Foote. "They just did a super job under the most difficult of conditions and with real bravery. Hemingway said "courage is grace under pressure" and it's difficult to imagine more pressure than this place was under. There couldn't be more courage in so many wonderful people than I saw displayed at this University."

CAUSE '92
Campus Perspective Sessions: "Internal/External Customers"
Donald E. Harris, Ph.D.
University of Maryland at Baltimore

In the Spring and Summer of 1992 the Information Services division of the University of Maryland at Baltimore conducted a survey of the campus. The goals of the survey included determining how faculty, administrators and staff were presently using computer technology and information resources, what evaluation they had of services provided by the division, and what recommendations they had for how the division could improve its products and services. The survey included two written instruments (one for academic users and one for administrative users) sent to random groups, and a series of on-site interviews with both users selected at random as well as selected by IS management from central offices and schools. In total 218 (app. 39%) responded to the written instruments and 85 (app. 86%) on-site interviews were held.

The survey proved to be a valuable exercise in better understanding the needs of our users. Based on the results from the written surveys and notes from the interviews a series of recommendations were forwarded to the Vice President for Information Services. These recommendations included the need to establish liaison roles between IS and the Medical School, the need to be more pro-active in bringing new products and services to users, and the need to work closer with the Hospital data center. It was also shown that more needed to be done in showing how information technology should change the way they work. In short the IS division needed to provide a vision for how information technology would change the campus in the future.

The success of the survey was due in large part to the straightforward methodology and honest attempt to implement findings. User recommendations were often incorporated into goals and objectives in the 1992-93 strategic plan. This document along with the survey results were widely distributed on campus. Where possible quick action was taken to bring faculty and staff new products or services they had requested. For those with a longer time frames milestones were defined for the coming year. Progress on those projects will be reported to user committees during the academic year.

If we could have done something better it would have been doing the two surveys as separate projects and then quickly reporting results to the user community. We might also have expanded our interview group to include senior administrators or perhaps those from other campuses to give us a perspective on how others are approaching common problems.

Involving Internal Customers at North Carolina State University
Jeff N. Hunter, National CAUSE92

Summary of Presentation

During the 1991-92 school year, North Carolina State University instituted a new approach to developing annual plans, combining the planning and budgeting processes. As a result, the Budgets and Administrative Systems Division, responsible for University budgeting and administrative information systems, invited staff to participate in the revised annual planning process. In addition, the Division management conducted the first employee (internal customer) survey to assess resource and training needs. This presentation will be a case study of involving internal customers, a first step toward total quality management.

Who are the internal customers?

The Budgets and Administrative Systems Division, reporting to the Vice-Chancellor for Finance and Business, is comprised of three departments with a total of 93 full-time, permanent employees. These employees represent the internal customers for this Division.

Why involve internal customers?

Involving internal customers is essential to improving the quality of operations and services which the Budgets and Administrative Systems Division provides. Giving staff the opportunity and responsibility to provide feedback and recognizing the value of internal customer input empowers staff to contribute more significantly to improving Division services.

How did we involve internal customers?

- Conducted surveys among internal customers for direct feedback.
- Encouraged internal customers to participate in the annual planning process.
- Invited all internal customers to annual meetings.

Results of internal customer involvement:

- In the first annual planning process 22 staff were involved, representing a wide cross-section of internal customers.
- Because of the results of the first survey, we administered a second survey, focusing on the training and supervision issues.
- The first pilot project for the development of client-server applications had only three staff volunteers. As a result of the collaborative planning process, more staff became informed about client-server computing and helped develop the Division's future direction. There are now 12 new volunteers for the next series of client-server pilot projects.
- Line staff became involved in the development of future plans, including participation in some key projects, such as, choosing 3270 emulation packages for Windows and DOS.
- The first Division-wide picnic was held with about 38% staff participation.

How can we improve internal customer involvement?

- Provide time for staff to participate in planning activities as part of their normal work duties.
- Empower supervisors to stimulate customer participation.
- Express to staff the value of their input as well as the importance of customer feedback.

What is the future direction of internal customer involvement?

- Conduct periodic reviews of the Division plan and welcome all staff to participate in the on-going process.
- Identify measurable objectives and indicators of success in achieving goals and objectives.
- Determine methods by which to measure the progress of goals and objectives to assure continuous improvement within the Division.

IT Role in Supporting QI

CAUSE92 Campus Perspectives Session on Total Quality Management

Jane Fox, University of Wisconsin Madison Graduate School

I'd like to address not how QI improved a computer operation but rather how computer services improved a QI project. If you extract the useful essence of QI, you get several principles that overlap with other business philosophies and methods. From process engineering come methods of tracking and analyzing processes, separating out causes and dealing with them appropriately, and basing decisions on data. Deming put these together and emphasized exploiting the expertise on the shop floor: bringing the people who do the work into the decision making.

Computer support staff, both local and central, have a new role as QI spreads through universities. QI's emphasis on data-driven decisions means teams need distributed data. And because project teams include people not trained in business management, it is particularly important that IT staff provide tools that are easy to use and that help team members understand the process they are trying to improve. A seat on the QI steering team puts an IT director in a good position to ensure that IT facilitates the process of improving processes.

At the University of Wisconsin-Madison Graduate School we receive more than 18,000 applications for admission each year. So far a QI project has decreased the time from the date the application is received to the date a refusal or acceptance is sent from 90 days to 60 while saving about $63,000 in staff costs even though staff were spending time on the QI project team.

Graphs and charts made it easier for the project team to understand the process they were studying. Macintosh TopDown diagrammed the progress of applications through the Graduate School and, at the same time, through department admissions committees. These charts also help staff in the graduate programs (some of our customers for this process) understand how the process works and is changing.

Although specialized QI software exists, we found it best to use familiar packages. For example, we used Paradox to record and then analyze responses to questionnaires filled in by departments. IT staff quickly wrote a simple PAL program to ease data entry. Paradox tables recorded comments as well as yes/no and numeric answers. Although it was important to be able to do statistics on questionnaire results, comments were particular significant for the insights they provided into what departments thought we were doing and wanted us to do.

QI projects benefit from close cooperation with programmers in the central unit. Fortunately in the year before we started the project the Graduate School had already worked with the central ADP to get applications for admissions data downloaded regularly. Copying data from the IBM mainframe to Paradox freed the project team from dependance on programmers and let the people who do the work work with the data. They use Paradox Quattro Pro, and Excel to analyze the data.

From Paradox relevant data went into Delta Graph, with which we printed charts on a $600 color printer. A bar chart showed the time applications took before the change in one color and the time they took after the change in another. Eliminating long waits in the Graduate School moved many applications from the bars for more than 80 days to bars indicating as short a time as one day. In fact we decreased the amount of time an application spends with us from two months to five days, but people applying to departments that wait till April to decide see little improvement. From our local data copies the team could extract data for individual departments. Bubble charts made it immediately obvious that different department were following different processes for dealing with applications. One of our next steps is to develop strategies for dealing with these differences.

IT has always served the university's processes. Today QI is starting new processes to improve the old ones, and QI processes always need the services of information technology.

Campus Perspectives
Total Quality Management

Evaluating Information Services for Quality Management using the Malcolm Baldrige National Quality Award

Mark Luker, University of Wisconsin, Madison

The Information Services Department of the University of Minnesota, Duluth, has been implementing total quality management for two-years. In 1991-92 we worked with a recognized expert in the evaluation of organizations for quality management. We based our analysis on the standardized exam for the Malcolm Baldrige National Quality Award, which is awarded by the federal government to those organizations that can demonstrate the highest levels of achievement in customer-focused, quality management. Taken as a self-evaluation, the MBNQA exam focuses attention on all aspects of quality management in the organization, and serves as a wealth of concrete ideas for immediate and long-term improvements.

The 1991 exam required an evaluation of 99 areas in seven major categories including leadership, information and analysis, strategic quality planning, human resource utilization, quality assurance of products, quality results, and customer satisfaction. We used a cross-functional team of managers and staff to evaluate our organization. They met in two long "focus group" sessions to establish consensus, then prepared brief, written summaries. This approach eliminates most of the effort required to prepare a real application for the award, while yielding much of the benefit in terms of a new and better understanding of the organization.

Scoring well on the MBNQA exam requires that your organization not only be "doing a good job", but be able to demonstrate continuous improvements with explicit measurements. Most organizations receive a low score the first time through but learn a lot about how they can improve all facets of their activities. The test can then serve as a measure of improvement over successive years. Whether or not you apply for the award, there is surprising value in the thought and discussion required to complete the exam.

Reference: Brown, Mark Graham; Baldrige Award Winning Quality: How to Interpret the Malcolm Baldrige Award Criteria; Quality Press, American Society for Quality Control; Milwaukee, WI

Campus Perspectives
Total Quality Management

Focus Groups as a way of understanding the Voice of the Customer in TQM

Paul Morris,Tufts University

1. Objectives of Focus Groups:
   - "Voice of the Customer": We wanted to understand the needs of our customers
   - We wanted to identify new and revised projects for our Five Year Plan
2. Used Focus Group technique because:
   - Poor response to earlier mail survey, not sure of which issues were of concern to users, wanted to avoid perceived biases by using independent professional, wanted to target key people
3. User groups selected :
   - Academic computing for Arts & Sciences, Academic computing for Health Sciences, Users of undergraduate advising system, department managers, administrative assistants, users of financial management information
   - 6-10 participants in each
4. Typical questions asked of participants to start discussion:
   - What processes and information are critical to the success of your job?
   - How can we improve the delivery and format of our services to help with these?
   - What are the barriers to your use of Information Technology in doing your job?
5. Analysis of Focus Group reports
   - Used "KJ analysis" to organize and identify issues (separate report available)
6. Focus Group tips based on our experience
   - It is worth using outside, non-political professionals
   - Publicize objectives, confidentiality, caring about the Voice of the Customer
   - Be aware that you are raising expectations about fixing problems
7. Focus Group findings about our customers perceptions:
   - We do not understand nor particularly care about our users' business needs
   - Users do not know what services we offer, how to get them or how to use them
   - We are not strong technically, and we provide poor service
8. Warning: Do not do this unless:
   - Your manager understands what the results will be, and you can deal with the political repercussions
   - Do not do this unless you really want to know what your users think about you, and you are willing to take vigorous action to solve their problems
9. Next steps, to be reported on forthcoming occasions:
   - Feedback with group participants
   - Questionnaire to validate findings
   - New & revised projects to fix problems
   - Discussions with senior management to agree on respective roles, services, funding

CAUSE92: CAMPUS PERSPECTIVES ON TOTAL QUALITY MANAGEMENT

Gloria Thiele, Manager Application Support Center
Information Technology Division, University of Michigan

My purpose is to describe how the Total Quality Management effort and the University of Michigan's System Development Methodology (SDM) have come together to influence the information technology efforts at UM.

Two years ago, the Information Technology Division (ITD) at UM launched a program to establish a philosophical base for TQM and to train its staff in the practices of total quality and the implementation of continual improvement. That effort was presented at CAUSE91 by Sam Plice, "Changing the Culture: Implementing TQM in an Information Technology Organization" and in the Summer, 1992 issues of **CAUSE/EFFECT**. TQM was first instituted at UM by the University Hospitals about five years ago. Since the successes described by Plice, their program continues to grow -- with a $2,507 profit sharing bonus to each Hospital employee while UM campus had no salary increases this year. University of Michigan Quality effort, M-Quality, began in August, 1991 with a Design Team charge to produce the report "M-Quality: Continuous Improvement at the University of Michigan." This report was distributed this summer and the associated training are the foundation of department, division, and School and College launched programs. The results of these efforts are: 1. A focus on the principles of continuous improvement, respecting people and ideas, managing by fact, and satisfying customers; 2. A common VISION, common LANGUAGE, and common SKILLS; and, 3. A growing demand to streamline and simplify processes.

The results of a strategic decision three years ago by University Information Systems to embrace a more standardized, streamlined, and manageable application development process resulted in the creation of our own System Development Methodology (SDM). The SDM is a strategy for developing systems, providing a consistent framework of tasks and deliverables needed to develop systems of all sizes and types. Its goal is to improve the development process by ensuring that information systems meet the customer expectations, to increase the manageability of the development process, and to maximize system development productivity. It provides a common VISION, common LANGUAGE, defined TEAM ROLES, defined OUTCOMES/DELIVERABLES, and was built on TOOL SUPPORT. It provides ADAPTABILITY to a changing University and technical environment and it provides ADOPTABILITY for many types of systems. It's a "road map" to efficiently guide a project from conception to system implementation.

The **LESSONS** that we have learned as a result of these two initiatives are:

Learn by Doing
Partnership/Customer Focus
Same Basic Principles: Different Domains
Continuous Improvement (P-D-C-A)
Some Need One Way
Role of IT Professionals in University Quality Efforts:

The **CURRENT QUESTIONS** that we will need to answer are:

Innovation: Initial TQM program centers on continuous improvement of existing processes. What tools and techniques are used to create the quantum leaps of innovation? Improve or Innovate Decisions? Identify OPPORTUNITIES FOR INNOVATION.

Re-engineering: As more UM departments learn about TQM and put the theories into practice, they will focus on their ultimate customers and the processes that they must go through to function at UM. This will drive a need to streamline and simplify -- RE-ENGINEER -- how we do business.

How does it all fit together?: Complimentary relationship between TQM and SDM.

Role of IT in TQM?: IT skills which can promote TQM are: analytical approach and systems thinking to problem solving, technology solutions when appropriate, innovative approaches and future thinking when looking for alternatives.

Campus Perspectives
Z39.50 Information Retrieval Protocol

The Pennsylvania State University
Eric G. Ferrin

At the 1989 CAUSE conference, Digital Equipment Corporation announced grants to The Pennsylvania State University and the University of California to support the linking of the library information systems at these institutions via the OSI applications layer protocol known as Z39.50. Through the use of this protocol, the users at each institution would be able to search and retrieve information from the other institution while using only the commands and features provided by their own system.

The development of the Z39.50 environment at Penn State focused around building a server to handle incoming requests from the University of California and integrating a Z39.50 client into the local information system, LIAS, to search the UC database. At this time, Z39.50 was undergoing evolution from version 1 to version 2, which complicated these development environments. The two institutions joined with other developers to form the Z39.50 Implementors Group which culminated in the approval of Z39.50-1992 as a national standard, upon which the Penn State implementation is based.

The broadened interest in Z39.50 also broadened the scope of Penn State's project. In addition to providing access to the University of California database, the project was expanded to other catalogs and databases as well. These included a number of abstracting and indexing databases as well as the library utilities: OCLC and RLG. While the expanded scope was welcomed by the eventual users of the protocol and also made the eventual product much more robust, it slowed the development environment because of both the wider diversity of databases served as well as the "startup time" that had to be invested with each additional developer.

During the implementation and testing of the Z39.50 capability, a number of problems were discovered, some solvable and others still to be addressed. Early in our testing, the network itself was often a problem. Response times across the United States varied greatly, from a couple of seconds to a half minute or more. The users tended to blame to local implementation rather than network delays. The upgrading of the Internet has made this less of a problem. The protocol itself also introduces perceived delays. While the local system retrieves and displays one record at a time, Z39.50 retrievals handle multiple records, with the associated retrieval delays for the whole set before anything is returned to the client and displayed to the user. The searching differences between systems probably produced the biggest set of problems. Z39.50 works by mapping local searches on the client to "attribute" combinations which are mapped back to local searches by the server. With over 200,000 attribute combinations, many early servers could never agree on a series of attributes to communicate with each other at all. The primary search command of our local system, LIAS, is to search on all combinations of Author, Title, and Subject - a type of search not easily supported in the University of California environment. Several search keys offered by the UC system aren't offered at Penn State at all. The error messages returned by the server further confused the user. When doing a subject search on a database with no subject keys, one server returned the message "Malformed Query". While a seasoned developer may understand such a diagnostic, the untrained user would be left perplexed at what she did wrong.

Perhaps the biggest problem faced in the introduction of Z39.50 at Penn State was user expectations. After almost two years of design and development, the users were disappointed because the searching of the University of California databases looked just like the searching of the local Penn State databases, which incidentally was the goal of the entire project. The commands were the same and the displays were the same. The weaknesses of LIAS were still there along with the strengths. The "sameness" amplified the problems with attributes and differences in indexing alluded to above. The user perceived the interface to be the same, and naturally extended that to the expectation that the indexing and retrieval should also be the same, which isn't true now and probably never will be.

The success of this initial implementation at Penn State highlights what needs to be done over the next couple of years. The protocol itself is missing a few necessary services, such as an Explain service so clients can learn more about individual servers, the databases supported, how they are indexed, and how to best search them, and a Browse service to expand the types of searching supported through the protocol. Databases of non-bibliographic data need to be built and the protocol tested with image, sound, and other data types. Vendor support of the protocol needs to be encouraged to enable the placement of more servers on the networks, as well as more general purpose clients that handle multiple data formats. As our experience as shown, Z39.50 can serve as an information retrieval protocol that uncouples the user interface from the database retrieval mechanisms.

Poster Sessions

Poster Sessions drew crowds at CAUSE92. At these informal sessions, conferees stopped by to learn more about successful campus experiences, displayed in poster form and shared by session hosts on a one-on-one basis.

Application Portfolio Assessment: A First Step to Focusing Your Limited Resources

Darrel Huish
Assistant Director, CIS, Arizona State University
Dennis Pramhus
Director, Computing and Information Systems, Arizona State University

An application portfolio assessment is a process to review and analyze the business and technical value of the enterprise's systems of automation. Each application system is evaluated against the business goals of the enterprise. It is also evaluated for compliance with the preferred technical architecture. The gathered data is accumulated on simple charts that visually show the health of the portfolio as a whole. These charts can help determine whether there is a greater need for system re-engineering as opposed to new system development. They can indicate which systems are candidates for downsizing. They can help answer questions about the ongoing quality of the portfolio by providing a baseline measurement that can be revisited on an annual basis. This poster session showed the initial efforts at Arizona State University—lessons learned, including the "do's" and the "don'ts."

A Campus Strategy to Address Computerphobia

Michael G. Dolence
Strategic Planning Administrator, California State University/Los Angeles

The fear of computers can significantly reduce the productivity of information age employees. With current research showing that as many as 30 percent of employees experience some form of computerphobia, colleges and universities must better understand and ameliorate this condition among students, faculty, and staff. Fortunately, options are available to assess and treat computerphobia, and early indications are that success rates can be very high.

California State University/Los Angeles is piloting such an effort. This poster session allowed attendees to learn the approach taken, assessment tools used, the preliminary findings of the campuswide assessment, some of the literature and principle researchers in the subject area, and treatment options. The subject is key to anyone charged with responsibility for the development or use of information technology on campus.

A Computer for Every Student: One College's Experience

David L. Votaw
Director, Computer Services, George Fox College

One year ago, George Fox College became the first college in the western U.S. to provide a computer to each incoming freshman student. The computer, part of a program called Computers Across the Curriculum, is included in the cost of tuition. Other features of the program include computers for all faculty, an increased level of technical support, and a retail computer store on campus. The computer provided is an Apple Macintosh.

With the first year completed, this poster session showed how faculty and students have responded to the program. An evaluation of program strengths and weaknesses was included for those who might wish to try this on their campuses. George Fox College is a four-year private liberal arts school affiliated with the evangelical Friends (Quaker) church. Enrollment in fall 1992 is 1,400, up from less than 600 in the mid 80s.

Disaster Recovery Planning: What Do the Customers Do While You're Down?

Larry D. Conrad, Director

Computer & Network Consulting Service, Arizona State University

Disaster recovery planning usually focuses on recovering the computer center, but that could take 30 to 90 days. At ASU, the Computer & Network Consulting Service is working with customers to develop "React Plans" to help them be prepared for an extended outage and still function. This session featured ASU's generic approach for developing a disaster recovery "React Plan" for a customer department, and the steps involved in putting one together.

Downsizing Trends: Case Study at the University of Tennessee

Alden Coleman

Assistant Director, Administrative Computing, University of Tennessee

The term "downsizing" has taken on several meanings during the past year. Within the Office of Administrative Computing (OAC) at the University of Tennessee/Knoxville this term is being defined by the Micro-Application Services group as the porting of applications or systems onto the appropriate platform. Downsizing usually results in moving applications and systems to smaller platforms. However, in some cases, it may mean porting to a mainframe platform. With the growth in network communications, local area networks, and PC computing power, coupled with the industry's movement to client/server-based computing, OAC was led to develop a strategy to migrate the University into a new culture to aggressively seek and embrace these new technologies.

The concept of moving the client closer to the data or database also applies when downsizing an application. Budget cuts at UTK are like those faced by most institutions today. Downsizing can result in some long-term savings for the institution. Five case studies were presented in this session, each using different downsizing approaches to solve department or division needs: Food Services and Menu Planning, Parking Service, Career Planning and Placement, Departmental Budget and Expenditure Application, and Division of Continuing Education.

A Funny Thing Happened on My Way to the Meeting: The Use of Humor as a Management Tool

Jan A. Baltzer

Director of Computing and Communications, Maricopa Community Colleges

Budget cutbacks, potential and actual layoffs, and the constant demand to increase productivity and quality while resources are diminishing, all add to the everyday stress level of information technology departments. Hard decisions must be made and such decisions can create conflict within the organization. Ralph Waldo Emerson once said, "If you would rule the world quietly, you must keep it amused." This poster session focused on the use of humor as a management tool that can be learned and effectively used to improve communication, resolve conflicts, increase productivity, and enrich the overall culture of the organization.

The Gateway Fax System: A Campus Strategy

James S. Cross
Vice President, Research and Information Systems, Longwood College

The fax machine has engineered a revolution in business correspondence in the past decade. This session described the portfolio of applications in the new integrated fax management system at Longwood College. The system has enabled the College to enter a new era in electronic messaging and information dissemination. It has meant: never receiving a busy signal while sending or receiving a fax transmission; the ability to prepare and transmit fax documents from the e-mail systems; automatic notification of new fax mail via voice mail, e-mail, beeper, or a telephone number to call; one-call delivery of voice, fax, and telex messages.

Planning and Implementing a Campus One-card System

Daniel Updegrove, Associate Vice Provost, Data Communications and Computing Services, University of Pennsylvania
Noam H. Arzt, Director, Special Projects Data Communications and Computing Services, University of Pennsylvania

More and more campuses are planning and implementing systems that use the identification card as a key to information and services. After almost two years of analysis and planning, the University of Pennsylvania consolidated its existing systems, and began to deploy a series of more robust systems based on its Penncard magnetic-stripe identification card. Penn, a large, private, urban university, was motivated primarily by a desire to provide robust building access control, as well as to be innovative in providing PennCard-based financial services to its students, faculty, and staff.

Recipe for Client/Server Success

Robert O. Little
Director, Computing Center, Lock Haven University

In the spring of 1991, Lock Haven University broke ground on a capital project to connect each of its 25 buildings via fiber optics. Bent on retiring their IBM 4381 mainframe, they acquired four IBM RS/6000 servers. Placing these servers on the fiber backbone, they have now established true "any-to-any" connectivity across the campus. High-speed laser printer stations were placed at strategic locations around the campus, and the University has just completed a connection to the Internet. The wiring of campus buildings and rooms is being completed by the maintenance department.

The largest RISC server handles a new CARS student/alumni information system, which was first used to register students during the spring of 1992. Another RS/6000 server runs a newly acquired Dynix library package, also implemented in the spring of 1992. A third server handles campus communications (e-mail and modems). The last RS/6000 was implemented as an academic server, and in addition to offering SAS and Mathematica, runs the IBM Higher Education Software Consortium repertoire for the RS/6000. In addition to the RISC machines, the University has implemented a Novell server for central management of licensed software.

The 11-person computer center staff started as a mainframe-oriented group, developing and maintaining custom CICS/IDMS applications. They are proud of their transformation into campus systems integration consultants, helping clients to select and implement high-quality packages and re-tooling themselves to provide training and consultation on all aspects of information technology.

Using Computer Bulletin Board Systems to Support Distance Learning

Joseph Williams
Assistant Professor, Colorado State University
Jamie Switzer
MBA Technical Coordinator, Colorado State University

The Distance Learning program at Colorado State University uses satellite broadcasts through Jones Intercable's Mind Extension University to present a Master of Business Administration degree. Approximately 100 students, geographically dispersed from Homer, Alaska, to Miami, Florida, are currently enrolled in the program.

Isolation of the distance learner from his/her classmates presented a problem that was difficult to solve without using expensive teleconferencing technologies. Camaraderie, interaction, and exchange of ideas were perceived to be meaningful classroom activities that needed to be made available to distance learners.

The solution to the isolation problem was provided in the form of a computer bulletin board system (BBS) that was pilot-tested in a course last spring. The test was a smashing success. Over 4,000 e-mail messages were generated by 67 students during the semester. The BBS software system cost less than $200. Substantial collateral benefits were harvested.

Special Sessions

In addition to the Track Presentations at CAUSE92, two Special Sessions were presented:

Odyssey: Teaching and Technology Come Together

Paul Privateer

Interdisciplinary Humanities Program, Arizona State University

Chris MacCrate

Research/Instructional Support/Information Technology, Arizona State University

The Odyssey model is an attempt to effectively blend a student-directed pedagogy (cooperative learning) which fosters active learners, with an instructional technology (computerized knowledge base) that presents information in a truly accessible format. While the hypertext environment of the computer component of the model allows students to discover information in a way that is very similar to the way they think, the classroom activities improve communication and social skills, and the students spend more time actually analyzing and synthesizing information.

From an implementation standpoint, another success of the Odyssey Project was the establishment of an effective infrastructure of support in the area of media services, instructional design, instructional technologies, and curriculum development. The story of Odyssey is not complete without detailing how this collaborative support team came together to make Odyssey what it is.

Americans with Disabilities Act: Recent Legal Developments

Megan Norris, Attorney

Miller, Canfield, Paddock and Stone

Ms. Norris is a frequent speaker and author on the Americans with Disabilities Act and is co-author of the 1992 edition of the chapter on handicap discrimination in the Michigan Public Employer Labor Relations Manual. She discussed the implications of the Americans With Disabilities Act, which went into effect on January 26, 1992, including types of accommodations that must be provided under the Act and policies and procedures that must be revised to comply with the Act. Her paper providing an overview of the ADA follows.

AN OVERVIEW OF THE AMERICANS WITH DISABILITIES ACT

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AN OVERVIEW OF THE AMERICANS WITH DISABILITIES ACT

BACKGROUND

The Americans with Disabilities Act ("ADA"), which was signed by President Bush on July 26, 1990, prohibits discrimination on the basis of disability in employment (Title I); services provided by public entities (Title II); public accommodations (Title III); and telecommunications (Title IV). Miscellaneous matters are set forth in Title V.[1]

Other than the Air Carrier Access Act of 1986 and the Fair Housing Amendments Act of 1988, the ADA is the only federal legislation regarding the disabled which is aimed at the private sector as well as the public sector. Members of the public sector have been the subject of a growing number of handicapper rights acts passed over the last twenty years.[2]

The ADA is not intended as an exclusive remedy and will not preempt state laws which are equally or more strict. Therefore, companies in states with disability discrimination statutes must comply with both the ADA and the state law, and an individual may bring an action under both statutes.

TITLE I - EMPLOYMENT

A. Entities Covered By The Act

Title I of the ADA provides that any employer engaged in an industry affecting commerce with fifteen or more workers will ultimately be covered by the Act. For employers with 25 or more employees, the employment provisions take effect on July 26, 1992. Employers with fifteen or more employees will be covered beginning July 26, 1994. The legislative history of the ADA provides that state and other public employers which have the requisite number of employees are included in the coverage of Title I of the ADA. Employment agencies, labor organizations and joint labor-management committees are also covered.

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[1] Excluded from this discussion of Title II of the ADA is consideration of the public transportation services provisions, which fall within the scope of the authority of the Secretary of Transportation.

[2] See, e.g., the Rehabilitation Act of 1973 (which applies to the federal government and recipients of federal financial assistance), the Architectural Barriers Act of 1968, the Education for All Handicapped Children Act of 1975, the Developmental Disabilities Bill of Rights of 1975, and the Voting Accessibility Act of 1984.

Specifically excluded from the coverage of the employment provisions are the United States, corporations owned by the United States, Indian tribes, and private membership clubs (except labor unions) which are exempt under §501(c)(3) of the Internal Revenue Code.

B. Individuals Protected By The Act

In order to qualify for the protection offered by Title I of the ADA, an employee of a covered employer must meet three separate tests. First, the individual must be "disabled" as that term is defined under the ADA. Second, the individual must be otherwise qualified for the position. Finally, the individual must be able to perform the essential functions of the job, with or without accommodation.

1. "Disability" As Defined By The Act

An employee can be "disabled" such that he or she is entitled to protection in four different ways:

a. Individuals Suffering From Determinable Physical Or Mental Characteristics That Limit Major Life Activities

First, an applicant or employee is protected under the ADA if he or she has a physical or mental impairment that substantially limits his or her major life activities.

An impairment is defined as a physiological disorder or condition, cosmetic disfigurement, or anatomical loss affecting one or more of several body systems, or any mental or psychological disorder. The existence of an impairment is determined without regard to mitigating measures such as medicines or assistive devices. Physical characteristics such as height, eye color, and left-handedness which are in the "normal" range, and thus are not the result of a physiological disorder, are not impairments. The definition of "impairment" does not include predisposition to illness or disease. Pregnancy and advanced age, in and of themselves, are not impairments.

Even if an individual has an impairment, he or she is not "disabled" under the Act unless that impairment substantially affects one or more major life activities. "Major life activities" are those basic activities that the average person in the general population can perform with little or no difficulty, such as walking, seeing, hearing, or working. Temporary, non-chronic impairments of short duration, with little or no longer term or permanent impact, such as broken bones, the flu, or appendicitis, are usually not disabilities. Except in rare circumstances, obesity is not considered a disabling impairment.

This first definition of disability extends to conditions such as orthopedic, visual, speech, and hearing impairments, epilepsy, multiple sclerosis, HIV infection, drug addiction, alcoholism, cancer, heart disease, mental retardation, emotional illness, and learning disabilities.

Alcoholism and drug addition are "disabilities" under the ADA. However, the Act specifically excludes from coverage current users of illegal drugs. In addition, although alcoholism is considered a disability under the Act, employers are not required to accommodate attendance or performance problems caused by the use of alcohol.

b. Individuals With A Record Of Disability

Second, an applicant or employee may be "disabled" within the meaning of the ADA if he or she has a record of an impairment that substantially limits a major life activity. This definition is intended to include persons who have had a disability in the past, like cancer or alcoholism, but have now recovered. The definition also includes persons who may have been misdiagnosed in the past as having a disability, such as those who were once identified as having a learning disorder. The mere fact that an individual has previously been labeled as "disabled," such as a disabled veteran or someone who has received disability income, is not sufficient to classify the person as "disabled" within this section of the Act. The record of disability must involve an impairment which substantially limits a major life activity.

c. Individuals Who Are Perceived As Being Disabled

Third, an applicant or employee may be disabled if he or she is perceived as being disabled. This part of the definition of disabled protects those who have an impairment which is not substantially limiting, but is regarded by the employer as being substantially limiting (such as high blood pressure which is not substantially limiting). The definition also protects those who have an impairment which is substantially limiting only because of the attitudes of others, such as a person with a facial disfigurement. Finally, this section protects those who have no impairment but are erroneously perceived as being disabled, such as a person who is rumored to have AIDS.

d. Individuals Related To Disabled Persons

Fourth and finally, a person may be considered disabled under Title I as a result of his or her relationship to a disabled person. This portion of the definition was included to prohibit employers from making adverse decisions about otherwise qualified employees based on assumptions about possible conflicts between job and responsibilities to a disabled person. The inclusion of this criterion in the definition of who is "disabled" for the purposes of the ADA, however, does not create an obligation for the employer to treat an employee with responsibilities for a disabled person differently or more leniently with regard to such things as consistently enforced attendance policies.

2. Otherwise Qualified For The Position

Even if an individual is "disabled" as defined by the Act, he or she is entitled to protection under the Act only if the individual is otherwise qualified for the position. For example, the individual must have the education, experience, or expertise required for the job.

3. Able To Perform Essential Functions With Or Without Accommodation

Finally the individual must be able to perform the essential functions of the job that the employee holds or is seeking, with or without accommodation. An individual will be protected if he or she is capable of performing the essential functions of the job at the time of the employment decision, even if the individual suffers from a condition that weakens, restricts, or otherwise damages his or her health such that the applicant might not be able to perform the job in the future. See, e.g., E E Black Ltd v Marshall, 497 F Supp 1088 (D C Hawaii 1980).

A function will be considered "essential" if the reason the position exists is to perform that job function. A function may also be essential because of the limited number of available employees among whom the function can be distributed. In addition, a function may be essential if it is so highly specialized that an individual would be hired for his or her ability to perform that function. In determining what functions are essential, courts will look to the employer's judgment, job descriptions, the amount of time spent performing the function, the consequences of not requiring an individual to perform the function, the terms of a collective bargaining agreement, and the work experience of those performing the job.

C. Prohibited Discriminatory Acts

Title I of the ADA prohibits discrimination against a qualified individual with a disability because of the disability in regard to application procedures, hiring, promotion, termination, compensation, job training, and other "terms, conditions, and privileges of employment." The Act then lists seven specific examples of prohibited discrimination:

(1) Limiting, segregating, or classifying a job applicant or employee in a way that adversely affects the opportunities or status of such applicant or employee because of his or her disability;

(2) participating in a contractual relationship that has the effect of subjecting the applicant or

employee to prohibited discrimination (e.g., contract with a labor union, referral agency, fringe benefit provider, or training organization);

(3) utilizing discriminatory standards, criteria, or methods of administration, including those that perpetuate discrimination;

(4) excluding or otherwise denying equal jobs or benefits because of an individual's relationship with an individual with a disability;

(5) failing to make reasonable accommodation or denying employment opportunities on the basis of the need to make such accommodation;

(6) using qualification standards, employment tests, or other selection criteria that screen out or tend to screen out individuals with disabilities, unless the criteria are shown to be job related and consistent with business necessity;

(7) failing to select or administer tests concerning employment in a manner which ensures that the tests accurately reflect the skills, aptitude, or other factors that the tests purport to measure, rather than merely reflecting the disability.

1. Medical Inquiries And Medical Examinations

Under the ADA, unlawful discrimination includes certain historically common practices regarding medical inquires and medical examinations. Whether or not medical inquiries or examinations will be allowed depends in part upon when the inquiry or examination takes place.

a. Pre-Offer/Pre-Employment

An employer can never subject an applicant to a pre-employment physical, ask whether the applicant has a disability, or inquire regarding the nature or severity of a disability before making an offer of employment. In addition, an employer cannot make pre-offer inquiries regarding an applicant's worker's disability compensation history.

An employer may make pre-employment inquiries regarding the ability of an applicant to perform job-related functions. If an applicant has a known disability which might interfere with job performance, an employer can ask the applicant how he or she would perform a job function, with or without accommodation, and can ask the applicant to demonstrate.

b. Post-Offer/Pre-Employment

After an offer of employment is made, but prior to the commencement of employment, an employer may require the prospective employee to take a physical examination, and may make the offer of employment conditional upon the results of that examination, if (1) all entering employees in the same job category are subjected to such an examination, (2) the examination is job-related and consistent with business necessity, (3) information obtained from the examination is kept in separate medical files and is treated as confidential, and (4) the results of the examination are used in accordance with the Act (i.e., only those employees who cannot perform the essential functions of the job with or without accommodation are rejected on the basis of the medical examination).

c. Post-Employment

An employer may conduct voluntary medical examinations which are part of an employee health program. In addition, an employer may conduct periodic physicals to determine fitness for duty or other medical monitoring as required by law, so long as the examinations are job-related and consistent with business necessity. The information obtained in these examinations is to be kept separately and treated confidentially.

d. Drug Testing

Tests for illegal drug use are not considered medical examinations under the Act. Therefore, an employer's ability to do drug testing is not affected by the Act. However, to the extent that a drug test reveals the use of legal drug use, such as an antihistamine which might be evidence of asthma, the drug test may be considered a medical examination. Therefore, employers should instruct the agencies performing their drug testing to only report the existence of illegal drugs.

e. Physical Agility Tests

Physical agility tests are not medical examinations. Therefore, they can be required at any stage of the application or employment process. However, because such tests often have an adverse impact in individuals with certain types of disabilities, the employer needs to be able to show that the test is job-related and consistent with business necessity.

2. Reasonable Accommodation

Under the ADA, it is unlawful discrimination to fail to provide reasonable accommodation which would enable an otherwise qualified disabled individual to perform the essential functions of the job, unless that accommodation poses an undue hardship.

Employers are required to make reasonable accommodation only for known physical or mental limitations of an otherwise qualified individual with a disability. Thus, the duty to accommodate is generally triggered by a request from an employee or applicant for accommodation. The Equal Employment Opportunity Commission has issued posters, which all employers should post, which invite employees to inform the employer of accommodation requirements. However, where an employee with a known disability is having difficulty performing the job, it is permissible for the employer to inquire into the need for an accommodation.

Title I of the ADA defines "reasonable accommodation" only by example. The ADA provides that "reasonable accommodation" may include making existing facilities used by employees readily accessible to and usable by individuals with disabilities, job restructuring, part-time or modified work schedules, reassignment to a vacant position, acquisition or modification of equipment or devices, appropriate adjustment or modifications of examinations, training materials or policies, the provision of qualified readers or interpreters, and other similar accommodations for individuals with disabilities.

The list is not exhaustive. This means that what constitutes reasonable accommodation will be decided case by case, depending upon the particular facts of each situation. See, e.g., Hall v United States Postal Service, 857 F2d 1073, 1080 (6th Cir 1988) (the Court held that the determination of whether a proposed accommodation is reasonable "is highly fact-specific and requires the court to engage in individualized inquiry to ensure that the employer's justifications reflect a well-informed judgment grounded in a careful and open-minded weighing of the risks and alternatives").

The following are examples of equipment or devices that may be required: electronic visual aids, braille materials, talking calculators, magnifiers, audio recordings, telephone handset amplifiers, telecommunications devices for the deaf, mechanical page turners, or raised or lowered furniture. However, personal items such as hearing aids or eyeglasses would not be included.

Reasonable accommodation under the ADA may include job restructuring, that is, modifying the job so that a person with a disability can perform the essential functions of the job. It may also include eliminating nonessential elements of the job, delegating or exchanging assignments, and redesigning procedures for task assignments. However, an employer need not eliminate essential functions of the job in question. See, e.g., Southeastern Community College v Davis, 442 US 397, 414 (1979) (the Rehabilitation Act does not require an institution to change the admission requirements of its nursing program to accommodate a deaf applicant where the ability to understand speech without reliance on lip reading was essential for patient safety during the clinical phase of the program). Courts have also held that an employer need not create a new position for a disabled employee. See, e.g., Davis v Meese, 692 F Supp 505 (ED Pa 1988), aff'd, 865 F2d 592 (3rd Cir 1989) (FBI had no obligation to create a permanent, limited-duty assignment for an insulin-dependent agent).

D. Defenses

1. Undue Hardship

The ADA provides that an employer is not required to make reasonable accommodation if doing so would cause "undue hardship." The definition of "undue hardship" under the ADA will be determined on a case by case basis.

The ADA defines "undue hardship" as action requiring significant difficulty or expense when considered in light of the following factors:

> (i) the nature and cost of the accommodation needed under the Act;
>
> (ii) the overall financial resources of the facility or facilities involved in the provision of the reasonable accommodation; the number of persons employed at such facility; the effect on expenses and resources, or the impact otherwise of such accommodation upon the operation of the facility;
>
> (iii) the overall financial resources of the covered entity; the overall size of the business of a covered entity with respect to the number of its employees; the number, type, and location of its facilities; and
>
> (iv) the type of operation or operations of the covered entity, including the composition, structure, and functions of the work force of such entity; the geographic separateness, administrative, or fiscal relationship of the facility or facilities in question to the covered entity.

This list of factors is not exhaustive, and the weight that will be attributed to each of these factors will vary with the facts of a particular situation. Moreover, the weight of a given factor turns on both the nature and cost of the accommodation in relation to the employer's resources and operations. The de minimis cost standard articulated by the United States Supreme Court in TWA v Hardison, 432 US 63 (1977) (which pertained to the requirement under Title VII to accommodate religious beliefs) does not apply under the ADA.

Cost is clearly a factor which courts have considered in determining undue hardship in cases brought under the Rehabilitation Act. See, e.g., Arneson v Heckler, 879 F2d 393, 397 (8th Cir 1989) (cost of part-time worker to assist plaintiff must be evaluated to determine whether employer met reasonable accommodation obligation). If an accommodation would cause undue hardship, the employer must provide the applicant or the employee the opportunity to provide the accommodation for him or herself. Moreover, the employer must pay for that portion of the accommodation that would not cause an undue hardship if, for example, the State Vocational Rehabilitation Agency or the employee or applicant pays for the remainder of the cost of the accommodation.

Among the factors the courts have looked to in determining whether an accommodation will cause undue hardship under other federal handicapper laws is what the impact will be on the other employees in terms of workload. In Treadwell v Alexander, 707 F2d 473 (11th Cir 1983), the Court held that providing a limited duty position to a "park technician" for the Army Corps of Engineers who had a serious heart condition and was limited to walking only a mile a day would constitute an undue hardship. Park technicians were required to do extensive walking and standing since patrolling land projects was among the essential duties of the job. The Court held that the accommodation would impose an undue hardship on the employer given the inevitable "doubling up" of a small number of available workers who would have to patrol a 150,000 acre site.

2. **Safety Of Self Or Others**

An employer is not required to hire an individual or to provide an accommodation if that individual or accommodation will pose a direct threat to the health or safety of the employee or others. See, e.g., Kimbro v Atlantic Richfield Co, 889 F2d 869, 878 fn 8 (9th Cir 1989) (safety considerations were the basis of the court's rejection of a proposed accommodation to allow a machinist who suffered from migraine headaches to compensate for absent time by working after regular hours).

The standard for "direct threat" is whether the individual poses a "significant risk," which is defined as "a high probability of substantial harm." A speculative or remote risk is insufficient. In determining whether an individual poses a direct threat, the employer should consider (1) the duration of the risk, (2) the nature and severity of the potential harm, (3) the likelihood that the potential harm will occur, and (4) the imminence of the potential harm. This determination must be made based upon objective, factual evidence about the nature or effect of a particular disability.

If a significant risk can be reduced to a remote risk through reasonable accommodation, the employer is required to provide that accommodation so long as it does not impose an undue hardship.

3. Food Handling And Communicable Diseases

An employer is not required to employ an individual in a food handling position if that individual has an infectious or communicable disease that is transmitted to others through the handling of food, as defined by the Secretary of Health and Human Services. Currently, this list includes diseases such as hepatitis. It does *not* include AIDS or HIV infection. Therefore, an employer cannot refuse to employ an individual in a food handling position simply because that individual has AIDS or has tested HIV positive. If there is an accommodation which would eliminate the threat of transmitting the disease through food handling, the employer must provide that accommodation.

4. Religious Entities

Nothing in the ADA prohibits a religious institution from giving preference in employment to individual of a particular religion, and a religious institution may require that all applicants and employees conform to the religious tenets of that institution.

5. Conflict With Other Federal Laws

It is a defense to a claim of discrimination that another *federal* law or regulation requires an employer to take certain action or prohibits an employer from taking certain action (such as providing a specific accommodation). Because the ADA is a federal law, and employers are required to comply with that law regardless of state law, it is *not* a defense that a *state* law may require or prohibit certain action.

E. Enforcement And Remedies

Title I of the ADA will be enforced by the same remedies and procedures provided for in Title VII of the Civil Rights Act of 1964. Therefore, an employee desiring to bring an action under the ADA must first file a charge with the Equal Employment Opportunity Commission.

The Civil Rights Act of 1991 has modified previous Title VII remedies. Now, a plaintiff alleging violation of the ADA's Title I may request a jury, and may receive not only back pay but compensatory and punitive damages. Punitive damages will not be allowed in a case involving an alleged failure to accommodate where the employer has acted in good faith in attempting to find a reasonable accommodation which does not pose an undue hardship.

TITLE II - PUBLIC ENTITIES

A. Entities Covered By The Act

Title II of the ADA provides that any State or local government, or any department, agency, special purpose district or other instrumentality of a State or States or local government, the National Railroad Passenger Corporation and any commuter authority are covered by the provisions of Title II.

B. Individuals Protected By The Act

The protections provided by Title II extend to individuals with a disability who, with or without reasonable modifications to rules, policies or practices, the removal of architectural, communication or transportation barriers, or the provision of auxiliary aids and services, meets the essential eligibility requirements for the receipt of services or the participation in programs or activities provided by a public entity.

Like the employment title, an individual can be "disabled" for the purposes of Title II in three different ways:

1. having a physical or mental impairment that substantially limites one or more of the major life activities of such an individual;
2. having a record of such an impairment; and
3. being regarded as having such an impairment.

Although Title II does not specifically define as "disabled" individuals who are related to disabled persons, the Department of Justice regulations prohibit discrimination on the basis of an individual's known relationship or association with an individual with a disability. This protection is not limited to those with a familial relationship with the individual who has a disability.

C. Prohibited Discriminatory Acts

No public entity shall discriminate against a disabled person, or exclude a "qualified individual with a disability" from participation in, or deny him or her the benefits of, the aids, benefits, services, programs or activities it provides on the basis of the disability. Such discrimination includes affording a disabled individual an opportunity to participate in or benefit from an aid, benefit, service, program or activity in a way that is not equal to or is separate from that afforded others. These prohibitions extend to the selection of procurement contractors and the administration of licensing and certification programs. They also mean that the public entity shall provide its services, opportunities and benefits in the most integrated setting appropriate to the needs of the disabled individual.

These prohibitions are generally based on the prohibitions in existing regulations implementing § 504 of the Rehabilitation Act, and on the prohibitions implicit in the requirements of those regulations. There are a number of similarities in this regard between Title II and Title III of the ADA.

It is unlawful discrimination to fail to accommodate an individual who requires such accommodation to use the benefits, services, programs, or activities provided by the public entity. The following types of actions may be required to accommodate an individual:

1. Reasonable modification of policies, practices and procedures

A public entity must make reasonable modifications of its policies, practices and procedures as necessary to avoid discrimination on the basis of disability, unless it can demonstrate that the modification would **fundamentally alter** the nature of the service or activity.

2. Effective Communication - Auxiliary Aids and Devices

A public entity must take the steps necessary to ensure that communications with applicants, participants and members of the public with disabilities are as effective as communications with others. Appropriate auxiliary aids and devices must be provided as necessary to permit equal opportunity to participate in or benefit from its services, programs and activities. The public entity must give deference to the choice of the disabled individual in the selection of an auxiliary aid or device.

For example, where the telephone is the primary means of communicating with applicants or beneficiaries, the public entity will likely need to have telecommunication devices for the deaf (TDDs). Reading devices or readers may have to be supplied to enable disabled individuals to review public documents, or forms needed to receive public benefits. Another example is "911" emergency service. The final regulations of the Department of Justice mandate that disabled persons must be provided with "direct access" to such services, not merely functionally equivalent service.

3. Existing Facilities

A public entity does not have to make each of its existing facilities "accessible." Title II requires only that each service, program or activity conducted by a public entity, when viewed in its entirety, be **readily accessible to and usable by** persons with disabilities. A public entity must make its programs accessible in all cases, unless it would result in a **fundamental alteration** in the nature of the program, or in **undue financial and administrative burdens.** This "undue burden" standard is intended to be much higher than the "readily achievable" standard of Title III.

A public entity may not, however, when selecting the site for construction of a new facility or selecting an existing facility to be used by the public entity, make a selection that has the effect of excluding individuals with disabilities.

4. New Construction

Buildings that are constructed or altered by, on behalf of, or for the use of a public entity shall be designed, constructed, or altered to be **readily accessible to and usable by** individuals with disabilities. The elevator exception discussed below in connection with Title III does not apply.

Newly constructed or altered streets, roads and highways must contain curb ramps or other sloped areas at any intersection having curbs or other barriers to entry from a street level pedestrian walkway.

D. Enforcement

Other than the public transportation services provisions, the Department of Justice will be the primary enforcement agency for Title II. The legislative history and the Department of Justices's comments to the regulations suggest that there is no requirement that an aggrieved individual exhaust administrative remedies before pursuing a private right of action "with the full panoply of remedies to individual victims of discrimination, including specifically but, not by way of limitation, attorneys fees and costs.

TITLE III - PUBLIC ACCOMMODATIONS

A. Entities Covered By The Act

Title III of the ADA covers public accommodations, commercial facilities and private entities that offer courses or examinations relating to licensing, certification or credentialing for secondary, post-secondary education, professional or trade purposes. Public accommodations are defined in Title III primarily by reference to twelve descriptive categories. A public accommodation for the purposes of the ADA is a facility operated by a private entity that is or is like:

1. a place of lodging;
2. an establishment serving food or drink;
3. a place of exhibition or entertainment;
4. a place of public gathering;
5. a sales or rental establishment;
6. a service establishment;
7. specified public transportation;

8. a place of public display or collection;
9. a place of recreation;
10. a private school or place of education;
11. a social service establishment;
12. a place of exercise or recreation.

Specifically excluded from the definition are facilities that are covered by or are expressly exempted from coverage under the Fair Housing Act of 1968, aircraft and rail cars.

B. Individuals Protected By The Act

Title III prohibits discrimination on the basis of disability by public accommodations. Like Title I and Title II, an individual may be "disabled" under Title III in three different ways:

1. having a physical or mental impairment that substantially limits one or more of the major life activities of such individual;

2. having a record of such an impairment; and

3. being regarded as having such an impairment.

C. Prohibited Discriminatory Acts

A public accommodation shall not, on the basis of the disability of an individual or class, directly or through contractual or other arrangements either deny the opportunity to participate in or benefit from or afford unequal goods, services, facilities, privileges, advantages or accommodations of a place of public accommodation. Separate or different goods, services, facilities, privileges, advantages or accommodations shall not be provided to an individual or class on the basis of disability unless necessary to provide the individual or class with goods, services, facilities, privileges, advantages or accommodations that are as effective as those provided to others.

Goods, services, facilities, privileges, advantages and accommodations shall be provided individuals with disabilities in the most integrated setting appropriate to the needs of the individual.

No private or public entity shall retaliate against an individual for opposing any discriminatory act or making a charge of discrimination or participating in an investigation of discrimination, or coerce, intimidate or threaten an individual exercising or to preclude the exercise of any right conferred by the ADA.

As with Titles I and II, it is unlawful discrimination under Title III to fail to accommodate an individual with a disability. Reasonable accommodation may include:

1. Reasonable modification of policies, practices and procedures

Title III requires that a public accommodation "reasonably modify" its policies, practices or procedures where necessary to afford goods, services, facilities, privileges, advantages or accommodations to individuals with disabilities, unless such a modification would **fundamentally alter** the nature of the goods, services, facilities, privileges, advantages or accommodations provided. Eligibility criteria that screen out or tend to screen out individuals with disabilities from fully and equally enjoying any goods, services, facilities, privileges, advantages or accommodations are prohibited, unless they are necessary to the provision of the goods, services, facilities, privileges, advantages or accommodations offered.

2. Provision of auxiliary aids and services

Title III also requires that public accommodations take affirmative steps to ensure that an individual with a disability is not excluded, denied services or treated differently by providing auxiliary aids and services unless the entity can demonstrate that taking those steps would **fundamentally alter** the nature of the goods, services, facilities, privileges, advantages or accommodations, or would be an **undue burden**, that is **involve significant difficulty or expense**.

3. Removal of barriers

Public accommodations must remove architectural barriers where removal is **"readily achievable"**, which is defined as **easily accomplishable and able to be carried out without much difficulty or expense**. If removal of barriers is not readily achievable, a public accommodation must use alternate methods, such as curb service or home delivery, if the alternate method is readily achievable.

4. New construction and alterations

A public accommodation will be found to have violated Title III if it fails to design and construct facilities for first occupancy after January 26, 1992 so that it is **readily accessible to and usable by** individuals with disabilities, unless it can demonstrate that it is **structurally impracticable** to meet the requirements.

Any alteration to an existing public accommodation or commercial facility made after January 26, 1992 shall be made so that **to the maximum extent feasible**, the altered portions, and related paths of travel if the alteration is to an area of primary function, are **readily accessible to and usable by** persons with disabilities, including those who use wheelchairs.

A public accommodation is not required to install an elevator in a facility that is less than three stories tall or has less than 3000 square feet per story, unless the facility is a shopping center, a professional office of a health care provider, or a terminal, depot or other station used for specified public transportation.

D. Enforcement

The primary enforcement agency for Title III is the United States Department of Justice. An aggrieved individual may institute a civil action for injunctive relief. The Attorney General may commence a civil suit and seek injunctive relief, monetary damages for the disabled individual or group and civil penalties which may not exceed $50,000 for the first violation or $100,000 for any subsequent violation.

Constituent Group Meetings

A number of subgroups of CAUSE members and conferees met at CAUSE92 to focus on issues unique to their shared work environments. These Constituent Groups are organized to encourage communication among professionals who share specific problems and functions. The groups meet during the Annual Conference and occasionally at other times during the year. The number and focus of the groups change according to members' needs.

Some of these groups have provided summaries of their conference discussions.

Administrative Systems Management
Coordinator: A. Wayne Donald, Virginia Tech

Chief Information Officers
Coordinator: Kenneth G. Pollock, Wright State University

Coalition for Networked Information
Coordinator: Leslie Maltz, Stevens Institute of Technology

Community and Two-Year Colleges
Coordinator: Albert LeDuc, Miami-Dade Community College

Data Administration
Coordinator: Daniel Updegrove, University of Pennsylvania

Executive Information Systems in Higher Education
Coordinator: James M. O'Neill, Boston College

Higher Education Users of Computer Associates Products
Coordinator: Nathaniel L. Felder, Southern Illinois University

IBM Higher Education Software Consortium
Coordinator: Douglas E. Hurley, University of Kentucky

Institutional Researchers and Planners
Coordinator: Richard Howard, University of Arizona

Medical/Health Science Schools
Coordinator: Carla T. Garnham, Medical College of Wisconsin

Multicampus/State Systems
Coordinator: Robert R. Blackmun, University of North Carolina

Small Institutions
Coordinator: Clyde R. Wolford, Le Moyne College

User Services
Coordinator: Carolyn Livingston, Tufts University

ADMINISTRATIVE SYSTEMS MANAGEMENT CONSTITUENT GROUP
Annual Meeting Minutes - December 1, 1992
Dallas, Texas

The annual meeting for the Administrative Systems Management constituent group was opened at 4:00 pm on December 1, 1992, by coordinator Wayne Donald. The meeting was held in the Obelisk A Room in the Loews Anatole Hotel, Dallas, Texas, with approximately 60 people in attendance. After some general introductions, the meeting proceeded with the agenda that had been distributed to CAUSEASM members on the listserv.

1. Wayne Donald requested that anyone interested in becoming the coordinator for CAUSEASM should see him after the meeting. Wayne has been coordinator since the group was started 3 years ago and feels there is a need for new leadership. He has agreed to remain as the listserv administrator since it is located at Virginia Tech.

2. Subscription to the CAUSEASM listserv continues to grow and much of that growth can be attributed to the "bite size" discussions started on the listserv in the past year. As of November 30, 1992, the CAUSEASM listserv has 250 subscribe. Ken Blythe, Penn State, expressed his interest in seeing that listservs are productive and not a waste of time. We need to understand why people don't participate, and see if there is a way to make listservs more useful. The "mediated" discussions on client/server technology on the CAUSEASM listserv have helped increase participation. Still, there is only a small portion of subscribers that actively participate and exchange information.

There was discussion about how much it costs to have a staff member participate on a listserv, that is, how much is it costing in productivity? Several in attendance offered their opinion on the value of listservs:

- If you can't afford to send people to conference, it's a good way for them to stay in touch with what's happening;
- staff members can find out about new things that are not published or readily available from other sources;
- the listserv can be a good tool --- maybe even a productivity tool; and, from one manager, "I actually encourage staff members to participate in list servers if it's one they feel can be helpful."

There are numerous listservs on the Internet and one might be tempted to subscribe to several. The majority of the group feels listservs can be useful, and that the CAUSEASM list server is one of the more productive ones available for administrative computing in higher education.

3. The majority of time allotted for the meeting was scheduled for Ken Blythe to review results of the client/server topic, which, over the past few months was broken into several "bite size" discussions. An 8-page report (front and back) and appendix summarize the discussions on this topic and was prepared by Ken, Sam Plice (Michigan), and Wayne Donald (Virginia Tech). The report was well received and Ken briefly discussed each of the 6 rounds. There will be no attempt to cover all the material in this report, but for the benefit of new subscribers and those not able to attend in Dallas, the 6 bite size rounds of discussion were as follows:

a. Real life cases studies of client/server applications in higher education.
b. Economic issues of client/server computing.
c. The changing role of central Information Technology (IT) organizations from providers of information technology to enablers of information technology.
d. Value factors that help select one client/server application over another.
e. Check-off list for evaluating client/server solutions.
f. Respective roles and responsibilities of central IT organizations vis-a-vis distributed organizations with regard to client/server computing.

A copy of the report can be obtained from the CAUSEASM listserv using the commands to get a file. Ken put an electronic copy of the report on the listserv in December, 1992. Therefore, to obtain a copy you need to enter the following command:

```
TELL LISTSERV AT VTVM1 GET CAUSEASM LOG9212
```

This command will send a file to your user ID. The report is imbedded in the file with other December, 1992, activity on the listserv.

4. A general discussion on client/server technology was held after Ken's summation of the report. It is very obvious there are still lots of questions to be answered. It was suggested the client/server topic be continued (Ken, Sam and Wayne agreed to continue to coordinate the discussion) to gather additional information. Among the information still needed is an inventory of who is doing what with client/server technology, and a taxonomy for client/server. These topics will be coming out in early 1993.

The group also discussed the need to continue along these lines of client/server technology and include bite size discussions for

a. How to handle management issues for client/server (such as data administration, security, and backup)?
b. What are the hidden costs for client/server?
c. Who has the responsibility for data integrity as we get more involved in client/server environments?
d. What infrastructure has to be in place at our institutions to make this happen?

All of these are certainly issues that must be addressed and it is hoped they can be continued on the listserv during 1993.

5. The discussion on client/server technology led to a more general discussion on how we, as information technology specialists, can get "up front" in helping define the right information architecture? Some responses to this were as follows:

- Centrally define a vision and infrastructure for the institution.
- Publish a standard information architecture that can be used for purchases, etc.
- Publicize as much information as possible---get it in front of the users and let them know a direction and what is expected of their areas.
- Develop a campus-wide information technology plan that is first adopted by senior management and then sent to departments.
- Get the users involved in various ways to assure they have a voice and are getting the information. For example
  - advisory committee for administrative computing
  - users group (for administrative computing or specific areas such as student systems)
  - cooperative development efforts
  - task force with representatives from major areas for months meeting

6. As the meeting was preparing to adjourn, Wayne Donald asked if, in addition to client/server technology, there were other issues that might be used for discussion in 1993.

a. It was suggested the issue of how to get "up front" in helping our institutions move in the right direction might be a good topic. For example, what are campuses doing to coordinate effort for administrative computing, or, for an information architecture?

b. How do you prepare for the "vanishing vendor?" For example, what do we do to prepare, who is successful, what can help us through "the troubled waters," what should the customers expect?

Coalition for Networked Information

Coordinator:
Joan K. Lippincott, Coalition for Networked Information

The Coalition for Networked Information held a Special Interest Group session as a means of providing an overview and update of the Coalition's program to the CAUSE constituency. The session was convened by Leslie Maltz, Director of Computing, Stevens Institute of Technolgy, who is a CAUSE representative to the Coalition Steering Committee.

Paul Evan Peters, Executive Director of the Coalition, opened the meeting with a description of the mission of the Coalition, an overview of its formation by the three founding associations (CAUSE, EDUCOM, and the Association of Research Libraries), and an update on the national networking scene. He reviewed the Coalition's areas of program emphasis, describing ongoing and planned activities.

Joan Lippincott, Assistant Executive Director of the Coalition, described several projects, including a briefing packet which is being developed for library and computing professionals. The packet covers policy issues related to networks and networked information and can be used to help individuals prepare presentations to administrators, faculty, and other consitutencies. In addition, an information packet for new network users is being prepared. Both collections of materials will be available on the Coalition's ftp file server as well as distributed in print form.

Craig Summerhill, Systems Coordinator of the Coalition, described the network services currently offered by CNI. These include a variety of electronic discussion forums to which any network user can subscribe and a new distribution list which will be used to keep individuals up to date on Coalition activities. He also described access to the Coalition's ftp file server where meeting reports and other documents are stored.

The attendees were asked to suggest ways in which the Coalition could respond more directly to the needs of the CAUSE constituency. A number of ideas were discussed, including having a more direct relationship with the CAUSE annual conference planning process, more programs on management-related issues, and increased communication with CAUSE members.

Community/Two-Year Colleges

Coordinator:
Albert LeDuc, Miami-Dade Community College

Approximately 20 people met during the CAUSE Conference to discuss mutual situations affecting information technology in community colleges. It was an informative and fruitful discussion. Our regular convenor, Gordon Mathezer, from Mount Royal College, was unable to attend. Despite that unfortunate circumstance, the meeting went well.

After sharing some basic information, we were treated to some examples of "good news." Jim Hill (Dallas County Community College) talked about his successful network installation. Al LeDuc (Miami-Dade Community College) shared the good news of a referendum supporting local taxation for the community College. Ron Bleed (Maricopa Community College District) noted the installation of a DRA library system.

Some common observations were batted around:

1) Touch-tone registration is not found in over 47% of higher education, with about 60% of CAUSE institutions being aboard that bandwagon.

2) Telephone fraud was noted as a problem of the future. At Trenton, the future has already arrived.

3) A Help Desk is also becoming standard, though there is little consensus on the right manning or authority for such an activity.

4) The building of a network infrastructure is a significant problem, little appreciated outside of the technical area.

5) Digital telephone (all the way to the desk) was said to open up a world of connectivity possibilities.

Discussion also focused on what CAUSE could do for community college members. Some suggestions:

1) The Constituent Group meeting at the conference may need to be scheduled with fewer conflicts. Attendance would have been better without conflicts with seminars, for instance.

2) The CAUSE Exchange Library should be used more extensively than it is, for example for common RFPs.

3) Can CAUSE get involved in such ideas as negotiating software costs over a broad base?

4) Additional communication among ourselves can (and does) occur outside of the constraints of the conference.

Denny Farnsworth and Ron Bleed also noted some things that CAUSE members should avail themselves of: There is always a need for volunteers for Board positions and for committees. While about 24% of CAUSE membership is within community colleges, CAUSE activities are not supported at that rate. There is a community college listserv, which has had very little activity. Anyone can be added to the list by contacting Denny at the CAUSE office. The listserv address is CAUSECC2@CAUSE.COLORADO.EDU. Messages sent to that address are sent to all the subscribers.

Data Administration

Coordinator:
Daniel A. Updegrove, University of Pennsylvania

Approximately 30 people attended this annual meeting to review and discuss the status of data administration policies and practices in higher education. Attendees first introduced themselves, identified their institutions, and described their involvement or interest in the area of data administration.

The primary focus of the meeting was on the topic of "data warehousing." This approach of placing data extracted from transaction-oriented systems into an easily-accessible repository is well under way at Arizona State University and the University of Michigan; efforts have also begun a the University of Massachusetts-Amherst. John Wasileski (ASU), Amy Brooks (UM), and Michael Bosworth (UM-A) described their efforts, successes, and what they might do differently.

A general discussion followed regarding the importance of standards, easily accessible documentation, date stamping, how to begin a data warehouse project, and how to get a data administration function started.

The tools of data administration were also discussed. Data dictionary tools mentioned were GQL User (UM), Brownstone (ASU), and in-house creations as well. Several institutions were beginning the use of CASE tools such as Deft, Bachman, IEF, and Knowledgeware.

The meeting concluded with discussions of resources for learning more about data administration: the DASIG listserv, local DAMA chapters, Data Management Review magazine, and CAUSE92 presentations. A list of all those attending the meeting was subsequently posted to the DASIG listserv to facilitate further contacts and discussions. To subscribe to DASIG, send the usual e-mail to listserv@suvm.bitnet or listserv@suvm.acs.syr.edu. The list owner is Sue Borel, Syracuse University, ssborel@suvm.bitnet.

After the meeting, Ron Spangler, Director of Institutional Research and Planning, University of Kansas Medical Center, agreed to convene the Constituent Group next year. Ron, who is also convener of the Association for Institutional Research (AIR) Data Administration SIG, can be reached via e-mail at IRRKS@UKANVM.BITNET.

Executive Information Systems

Coordinator:
James M. O'Neill, Boston College

This session was attended by approximately 30 people representing a broad cross-section of schools all over the U.S.—public, private, large and small. Also present was a representative of a consulting firm interested in building an EIS for use within his firm. A large number of the participants were not aware of the EISSIG listserver and Jim O'Neill provided them with information about how to get on the list.

The participants introduced themselves and gave brief remarks about their level of involvement in EIS/DSS and the status of any projects at their schools. Most of the participants were at the stage of gathering information or planning for the implementation of executive systems, and had come to the meeting in hopes of learning from the experiences of other institutions. Many had some form of DSS, usually involving end-user SQL tools for accessing campus data in SQL relational databases.

Jim O'Neill described an EIS prototype developed by Boston College which is about to enter the user testing stage. This project makes use of a Macintosh as the executive's workstation. Summary "census" data is stored locally on the user's hard drive in MUSE databooks (MUSE is a multi-dimensional database/spreadsheet product of Occam Research.) Users access real-time data through a Mac-style front-end to IBM mainframe administrative transactions (using the BOTH software application from Connectivite.) Both types of sessions are accessed within a navigational environment written in SuperCard (from Silicon Beach, a subsidiary of Aldus.) The prototype includes two applications (1) access to six years of year-end financial data with drill-down from the University level down through VP groups and schools to individual departments and accounts for each expense category; (2) access to summary information about each academic and administrative department in a single place (i.e. data on faculty & staff, space, budget, students, grants, etc. all on one or two screens for any specified department.)

Carolyn Livingston of Tufts University indicated that they were building an EIS prototype using the Focus/Pilot Lightship products in a MS Windows environment. Tufts already uses Focus extensively for management reporting and is finding that they can use existing Focus reports to move data into the EIS environment.

Frances Chambers at Baylor reported that they have recently implemented departmental information systems. These systems take data from a large number of different systems and bring them together in a UNIX/Sybase environment which can be accessed by departmental users regardless of the platform they are on (and Baylor has a wide variety of platforms represented among its departments.) Frances indicated that they knew they could never answer every question any department had, but they thought they could answer about 80% of the information needs. They worked with a committee of user representatives drawn from their departments to develop a standard package of data elements to be provided for downloading to each department's platform of choice. They maintain three years of data on-line and have about 300 users. They are now hoping to develop executive level access tools for similarly designed systems. During the development stage the project was worked on by one systems analyst and three programmers.

The session also dealt with several general issues. Barry Walsh of Indiana University did a quick poll of the group on the issue of security and open access to data. It was clear that at most institutions, access to data was relatively tightly controlled. In a few large public systems, information not explicitly confidential as a result of federal or state law is now considered to be available to the public at large. These institutions are concerned about policies and methodologies for providing access to this information by the public.

We also polled the group to determine who within the institution is considered to be the owner of the database. In a couple of schools the University has formally taken possession of the database and given functional administrators guidelines for their "stewardship" of the data. In most institutions the functional department still feels an ownership interest in the data gathered and maintained by their department. Most data flows up through the chain of command and managers are frequently reluctant to have senior managers directly accessing the database without their involvement. Several participants felt that managers were more worried about providing access to data in machine-readable form than on paper. Those representatives who had systems in place suggested that it was easiest to start with all the restrictions that concerned managers wanted. Little by little the managers get more comfortable with the notion that data has to be shared and begin to ask for the ability to share more and more of "their" data with others.

In response to a request from the CAUSE staff, we discussed what issues in the EIS area would benefit from assistance from CAUSE. The group made these suggestions: (1) continue to publish papers on EIS/DSS topics; (2) lobby for and work toward better full-text distribution (at reasonable costs) of articles on technology topics (from CAUSE's own publications, but also from other journals and magazines) of interest both to tech staff and to senior managers dealing with technology; (3) pick up publication of the data in Charlie Warlick's computing directory; (4) work with government agencies or other professional organizations to develop a standard set of definitions and data elements for higher education, especially for costing/measuring information technology services/investment; (5) negotiate/lobby for reduced educational pricing structures for software.

IBM Higher Education Software Consortium

Coordinator:
Douglas E. Hurley, University of Kansas

The convenor for this year's meeting was Ron Wills, Portland State University. The Higher Education Software Consortium (HESC) Constituent Group gives CAUSE participants an opportunity to learn more about the HESC and about current program offerings, and to discuss issues related to HESC directly with IBM ACIS. Due to a scheduling conflict, the primary IBM ACIS HESC coordinator was unable to attend. Mr. Jon Hardt, IBM ACIS, agreed to field questions and get answers if he was unable to provide them. There were approximately 10 CAUSE particpants along with several IBM representatives.

Several questions were raised concerning the possibility of and need for PS/2 based software. Of particular interest was TCP/IP which is broadly needed to access mainframe resources over TCP/IP based campus networks.

Ron Wills, a member of the HESC Steering Committee, reviewed the recent HESC Executive Committee meeting held at EDUCOM 92. At that meeting, the Executive Committee voted to abolish the current HESC committee structure and to reform as a new advisory committee with a new and broader charge and membership. The new committee will focus on representing academic software needs for higher education to IBM, and to serve in an advocacy role to IBM for the unique needs of higher education.

All HESC subscribers were reminded that in order to keep HESC costs down, any software ordered under the HESC which is not actually installed and used, should be discontinued.

User Services

Coordinator:
Carolyn Livingston, Tufts University

During the 90-minute meeting, fifteen people discussed the following topics:

- Training in new technology
- The use of Computer-Based Training (CBT)
- The task of supporting varying levels of computer literacy
- The establishment of standards in hardware and software
- The task of supporting users who decide not to use the recommended standard
- The distribution of computing but not the resources
- The relationship between Central Support and the Users
- Help Desk
- The shift in resources from the mainframe to PCs

How can CAUSE, as a professional association, help the group with these challenges? There were three recommendations:

1. Conduct a survey on the use of CBT's in member institutions.
2. Set up a clearinghouse of microcomputer-level materials that other members are willing to share.
3. Set up a list serve to allow members to maintain their contacts and to continue the above discussion.

"Writing for *CAUSE/EFFECT*": A Round-Table Workshop

Hosted by:

C. Edward Mathay
Director of Computing and Telephone Services
Marquette University
1992 CAUSE Editorial Committee Chair

Gerald Bernbom
Assistant Director, Data Administration and Access
Indiana University
1993 CAUSE Editorial Committee Chair

Julia Rudy
CAUSE Director of Publications and Editor

Members of the CAUSE Editorial Committee

A round-table workshop for those interested in learning about writing for *CAUSE/EFFECT* magazine was held at CAUSE92. Participants brought ideas for articles to the workshop for informal discussion with members of the CAUSE Editorial Committee, who shared their experiences as reviewers for the magazine, and answered questions about what makes an article a good candidate for publication in *CAUSE/EFFECT*.

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TRACK I

LEADERSHIP IN STRATEGIC PLANNING AND MANAGEMENT

Coordinator: Margaret Drake

Colleges and universities are facing an unprecedented reassessment and realignment of missions, customers, and stakeholders. Turbulent economic and social times demand a comprehensive and thoughtful strategic planning process guided by strong and able leaders. A fundamental survival strategy is the careful deployment of information technology in curriculum and research areas as well as in the administrative infrastructure of our institutions. Information technology leaders are thus positioned to be key contributors to shaping institutional strategic planning and management.

Information Technology Excellence: It's Not Instant Pudding
Applying TQM to IT

Linda H. Fleit
EDUTECH International
Bloomfield, CT 06002

Total Quality Management, the Deming Method, the Parable of the Red Beads,.... Just new bandwagons and buzzwords or truly something worthwhile we can use to guide our information technology efforts? This paper presents an exploration of TQM as a new and intriguing way to pursue excellence and the ways in which TQM can be productively applied to higher education information technology.

Icy fingers grip your heart. You've just returned from lunch and sitting on top of your stack of messages is one from the president, saying she wants to see you right away. With lightening speed, the three or four reasons she might have called you race through your mind... She wants to congratulate you on your success in developing the new tuition billing system. She wants to talk about putting a workstation on her desk. She wants to talk about training her secretarial staff in WordPerfect.

Deep down inside, you know it's none of these things. By the time you get to her office, you've begun to hear whispered rumors in the hallways. The president's secretary greets you with sympathy in her eyes. You walk into the inner office, and there they sit: the president, the vice president for development, and one of the trustees. How could this have happened, the vice president for development says to you. How could the last set of special donor acknowledgments have gone out in the mail, over the president's signature, riddled with errors, including mistakes in the dollar amounts received and the spelling of some of the names. The donors have been calling, he says, confused and annoyed.

You try, of course, to put the best face on it with them, try to look like you knew all about this and that a fix was already in place, try very hard not to be defensive or to shift the blame onto the development staff for not checking the letters before they went out, and of course, try to assure the president that this can never, ever happen again.

By the time you leave her office, you are wondering not how it could have happened; there are many ways this problem could have happened, unfortunately. Rather, you are wondering, how could you have been blindsided this way? Why the heck didn't someone on your staff let you know about it before you found out from the president?

Your staff knew what was going on. But instead of telling you, they were trying to fix it themselves. They didn't want to bother you. Your door was closed. They thought it was a minor problem. For any number of reasons, they didn't let you know. You were left vulnerable.

The bottom line is that after all of your hard work, your major investments of time and energy, and your dedication to what you thought was right, you've just moved back about ten steps. You've lost credibility with the person with whom it counts the most. Try now going into that meeting next week to explain the new capital expenditures you need to hook up the remaining buildings to the campus network. Try asking that your department be exempted from the campus-wide hiring freeze.

This mess will get cleaned up, of course, and you and your staff will survive. Until next time. The question is, does there have to be a next time? Do we have to take it for granted that there will always be a certain number of errors in the computer center? Do we have to assume that information technology is inherently troublesome?

We're going to take a look at that issue today, because as information technology professionals, we owe it to ourselves, to our departments, and to our institutions to examine ways to ensure that the work we do consistently meets the goals that it should. There's a lot of evidence that we are perceived by our institutions as either not setting—or not meeting—appropriate goals.

And why is it so important that we do? Why has this taken on, in fact, a most critical importance in the last few years? Because our institutions are struggling. We see it every day. Enrollments are down. Tuition income is down. Donations are shrinking. We are hearing that some of our educational programs don't mesh with real world needs. That our colleges are not keeping up with the times. The public is looking very critically at institutions of higher learning. So are federal and state governments, which are themselves under pressure to assure that tax dollars are being spent wisely.

These are critical issues. These are the issues your president is thinking about late at night. There doesn't even have to be a crisis of incorrect donor acknowledgements; pressures of all kinds are impelling presidents and other decision-makers at our institutions to look very, very carefully at the value of information technology.

Two of the most frequently asked questions on our campuses today are: "What are the benefits of information technology to this institution?" and "Have all of our expenditures (mostly large, and certainly larger than in many other areas of the institution) been worth it?"

Oh, certainly, the president knows that the school needs the services of a strong computer center. He knows that a payroll can't be produced without a computer, or a tuition billing. He may even know that a good library can't get along without computing anymore. But does he or she think of the IT area, the way it is currently run, as an asset to the institution or as a drain?

The president of a major midwest multi-campus university told me recently that he would like to curtail all further expenditures on new technologies for two years. "We have so much technology already ... and we don't use a lot of it," he told me. "Someone probably knows how, but we really don't have the expertise and the training to make this stuff work for us. I'd like two years of no new technology just to catch up."

That's not much of an endorsement for continuing to grow the information technology area. And he's not alone. An article not long ago in *The Chronicle of Higher Education* put it this way: "The computer center has replaced the library as academe's bottomless pit."

So the question for us is, how do we ensure that our information technology departments are genuinely useful to our institutions? How do we avoid running a "bottomless pit"? How do we make the benefits of technology so obvious and so outstanding that everyone will want to move forward, including the president?

My answer is that our information technology organizations need to reach a considerably higher peak of excellence than the one most of them are on at the moment. My purpose today is to talk about a concept and a set of tools called "Total Quality Management" that may help us as we strive to develop excellence in the ways in which we manage and use technologies within the higher education community.

You've already heard probably about TQM in a variety of places, and some of you may have already written it off as a fad. Let me assure you that I am also very wary of management fads. In the last ten years alone, we've seen a slew of them: One-Minute Management, Management by Objectives, Management by Walking Around, Bottom-Up Management with Top-Down Planning, Management by Neglect, and of course, the ever-popular Mushroom Management, which is keeping everyone in the dark and throwing fertilizer at them at regular intervals.

I think we are rightfully reluctant to hitch our wagons to any one set of principles without a highly critical look at their actual short and long-term value. We have been bombarded in the last decade with faddish programs, systems, and processes—none of which seems to make a bit of difference in the stark light of day. Nevertheless, I am convinced that Total Quality Management has the potential to move us in a positive direction toward excellence.

For one thing, TQM is a system that has worked well for several decades in other parts of the world, and has become very popular in our country in the last few years. Clearly, the focus up until this point has been in the business and industrial sectors, but higher education itself is beginning to embrace TQM; we're seeing things like a recent issue, for instance, of *The Bulletin* of the American Association of Higher Education devoted to TQM in the collegiate environment.

Total Quality Management, known to some people as the Deming Management Method, was developed by several people, most notably W. Edwards Deming. Deming gained fame in the 1950's by enabling Japanese industrial systems to achieve their reputation for quality. In fact, they were so pleased by his work that they awarded him the highest honor to be given to a non-Japanese: the Second Order of the Sacred Treasure.

Deming's theory has been reworked and expanded upon by a number of people, and has been synthesized any number of times into some number of components. You may have heard about the "fourteen points for management" or the "ten components of Total Quality Management" or other descriptions of the basic elements of TQM. Basically though, it comes down to three critical issues.

The first is that whatever you do, what ever business you are in, your work must be driven by, and focused toward, the customer. You have to know who your customer is, and even in a college or university setting, where you might think that the answer to this obvious, knowing who your customer is isn't always easy to do. We'll talk more about that issue in a bit. You have to know what your customer wants, you have to know what your customer needs, you have to know what your customer values. Most of all, you have to know what your customer thinks quality is.

The second critical issue surrounds process. TQM is based on the principal that process, or the flow of work activities, is the critical factor in attaining quality. Even more importantly, the process needs to be guided by a truly customer-oriented focus.

In serving the customer efficiently, we need to minimize unnecessary complexity, reworks, and the need to scrap whole projects.

But how do we ensure that we are serving the customer? And how do we enhance our efficiency so that we don't make the same mistakes, cover the same ground, and waste our efforts—over and over again? TQM attempts to address these concerns by concentrating on two important factors: design and output.

Design refers to what it is that we intend to do. In programming, for instance, it would be defined as the intended characteristics of the program being produced. Questions to be asked include: Does it meet the customer need? Do we know how to program it? What do we need—from materials to brain power—to program it correctly?

Output refers to the actual product. For the output of a programming project, we can't just look whether it works during the testing phase; we also have to look at look at things like structure, maintainability, and documentation—in other words, the totality of the output.

Both of these characteristics, design and output, must work together in harmony. It is quite possible for a product to be superlative in its output characteristics, but lacking in design. A good example might be an elegantly crafted program that produces student bills. It could be absolutely beautiful in its craftsmanship, but if it doesn't include housing charges or financial aid awards, it might not be what the user wants. And if it fails to meet the primary goal of serving the customer, then it doesn't matter how elegant it is, it has failed.

The third critical issue in TQM is staff involvement. Many of you may have read a recent article in our newsletter, *The EDUTECH REPORT*, which talked about a recent fire at Fordham University. One of the authors, Walter Weir, Fordham's executive director of computer and information management systems, made this point: "When the fire occurred and we had to send our network people in to repair the damage, no one had to stand over them and say, 'You do this and you do that.' Each one knew exactly what needed to be done and got on with doing it. They had the right tools and they had the authority; as a result, they were able to save us from what could have been a major catastrophe for this university. In fact, they were able to resolve it in such a fast and expeditious fashion that many people were totally amazed." Why did this happen? Because months before, they had instituted TQM in their department, and by the time of the fire, had already been actively engaged in team building and individual empowerment. The results really paid off in a tangible way for them.

So that's all there is to it. Customer focus, process improvement, and staff involvement. Sounds kind of like motherhood and apple pie, doesn't it? Of course, it's not that easy.

In a recent Computerworld article, Joshua Hammond, president of the American Quality Foundation, made a crucial point about quality. He was talking about businesses, but I think we can extrapolate to include ourselves as well.

Hammond stated that, "The problem is that many companies are chasing this goal without a clear sense of where they are trying to go or how difficult a journey they should expect." In other words, as Deming himself said, it's not instant pudding. You can't just simply mix all the ingredients together and hope for the best. It takes real work.

Let's revisit each of the three critical components of TQM and see how they apply to what we do in IT. The first one is customer focus.

Peter Drucker, the management guru, made these comments in one of his books, *The Marketing Concept*, "Every successful organization has always asked: Who is the customer? What is the value to the customer of what we do? How does the customer use what he or she acquires? And, what does the customer need?"

Let's look at the first one. Who are IT's customers? On one hand the answer is obvious: IT's users, or customers, are students, administrators, and faculty. But that's only if you cut it one way, and describe the user base along functional lines. You could also put it this way: our customers are mainframe users, minicomputers users, and microcomputer users. Or you could say your user base is made up of three groups: potential users, infrequent or undemanding users, and very frequent or demanding users. Or you could say your customers are in two groups: happy and unhappy.

It matters very much who your customers are, because it has implications for how you organize your services, and what services you provide. For instance, one of the classic organizational issues is whether there should be combined or separate computing centers for faculty and administration. Well, if an administrator who is using a Macintosh for analyzing downloaded data from a large IBM mainframe has to go to the academic computer center for assistance with a Macintosh problem because that's the only place on campus that anyone knows about Macintoshes, there is reason to question whether that division between academic and administrative makes sense anymore.

There are any number of ways you can define who your users are. The important thing is that you do it so that it makes sense for your institution.

The next question we have to ask is whether it is the users, or something else, that really drives our work. Do we have the idea that we have to lead the users in order to make progress, or do we let the users always take the initiative? We worked with a school earlier this year that was one of the first to institute telephone registration. In fact, they put telephone registration in almost as soon as the technology became available. In looking at the institution in some depth, one of the things we discovered is that the project had been initiated, and led, by the IT folks, with the registrar a somewhat reluctant participant, and the deans brought along literally kicking and screaming. Then it turned out that among other things, the student information system did not have automated transcripts or on-line grading, both of which were rather high up on the registrar's list of priorities. The telephone registration project was a big one, and took lots of hard work and plenty of resources. Were the IT people heroes when they made it all work? Anything but. They were leading the users with an IT agenda, according to the things IT thought were important to the school.

And that leads us into the area of performance judgements. Do we use the customer's criteria to judge our performance, or do we use our own? We're measuring CPU cycles and network bandwidth but they're measuring how many attempts it took to get a file transferred from Mac WordPerfect to DOS WordPerfect. We have to learn that excellence in information technology comes from one thing only: customer satisfaction; not from the number of MIPS in the computer center, not from the speed of the campus network, and not from the number of lines per day the programmers code.

The second critical issue is process improvement, and its two components, design and output. One of the things we often miss is linking the design to its purpose. Somehow we got the idea that solving the technical problem means solving the problem; in fact that is rarely the case. One of the most interesting experiments that Deming conducted has come to be known as the "Parable of the Red Beads." This experiment is critical to understanding the operating philosophy of TQM.

In this experiment, we have several thousand beads in one container, most of which are white and some of which are red. Management has decreed that we must collect only white beads, because that is what the customer wants. We are given another, larger container and a paddle with holes in it that are just smaller than the beads. The task is to pour the beads, in a precise manner dictated by management, into the larger container, then to extract only the white beads, using the paddle. Of course, inevitably some red beads will get into the extracted group. Our work will be monitored by two quality control inspectors. It is the role of the first inspector to record and count the number of red beads on the paddle each time it is removed from the larger container. The other inspector verifies the first inspector's tally and is ultimately responsible for reporting the final count. In addition, although both inspectors continually urge the workers to improve quality, they are in competition with each other to uncover mistakes made by the other.

Not surprisingly, the quality of results produced in this situation varies, even though each worker adheres to stringent guidelines. After each worker had some number of tries, it is possible to establish data to show the results attained by each worker, and by the group as a whole, and to establish upper and lower control limits.

I know—we don't simply separate red and white beads as we manage information technology. Life would be a lot simpler if we did, or if our complex responsibilities could be reduced to assembly line logic. But can we take anything away from the Parable of the Red Beads? Deming suggests we can learn five important truths from his experiment. The first is that variation is part of any process. Quality will vary. Mistakes will happen. This is as true in our computer centers as it is on the assembly line. Perhaps truer—we have so many possibilities for error!

The second point is that, in order to plan effectively, we must be able to predict and measure results. Deming has said, "In God we trust. All others must use data." And with good reason. The quantitative measurement component of Deming's philosophy is one of the most distinguishing aspects of it.

Third, in general, the system in which workers must perform is beyond their control. They work under strict guidelines, and the system, like the container of red beads with white ones among them, is riddled with defects.

This leads us to the fourth point, which is an important one. By and large, in this experiment, only managers are in a position to change the system. They control the procedures and the rules. Even the most talented and skilled workers are powerless to change the monolithic system in which they perform.

The fifth point is that some workers will consistently be better than others. I'm sure you know what I mean. There are people in any department to whom we inevitably turn when a job needs to be done correctly the first time. And there are others whom we watch closely to try to guard against serious errors.

This understood, Deming concludes that we should accept variation in human ability, as much as possible, and look instead at the system, or the process. It is the system that must be shaped, first to meet the needs of customers, and next, to accommodate the true abilities of workers. The single most important message here is that the system should be viewed as a whole, that it can be improved, and that dents in quality come from flaws in the process.

The third critical issue is staff involvement. One of the myths about quality is that in order to achieve a higher level of quality, we need more, and perhaps better, people than we have at the moment. In contrast, one of the principles of TQM is that quality can be achieved with the people we have right now, through better training and development. Two key components work together: individual empowerment in concert with team building.

Let's look at the first one: individual empowerment. Basically, this means giving staff members the opportunity to influence what's going on around them. Instead of simply doing work that they are assigned by a higher-level person, staff members help shape the very goals and objectives of the IT department itself. After all, with the emphasis on customers, who they are and what they need from us, who better to guide that direction than the people who have been working most closely with the customers all along? Who is likely to know better the needs of the Registrar than the programmer/analyst who has been working on the student information system for the last two years? Who is likely to know better what the students who use the computing labs need than the student lab assistants?

Organizational models are changing. The staff in information technology needs to take on a new and crucially important role. They are there not simply to take orders from above or to be informed of the latest round of decisions made by others. Rather, they are there to be aggressive in contributing to problem solving, to taking new initiatives, and to being much more self-directed than has ever been the case before in our traditional hierarchical organizations.

But with less management control comes an equally important steadying device, to make sure that individual empowerment does not go off in different directions. That device is working in teams, one of the cornerstones of the TQM philosophy. Now, many of you might say, well, at least that tradition is already well-entrenched in higher education—everything is already done by committee. But this is different. TQM teams are not committees in the sense that we know them. They are self-directed work groups. They are not necessarily made up of people "representing" different constituencies the way most committees are; they are made up of task-oriented people involved with a particular process and who want to get a particular problem solved. And they do not go on forever. They are formed specifically to tackle a quality issue, and when they have done that, they disband. It is this kind of collaboration that gets things done.

There are great benefits to be derived from substantive staff involvement. But we have to remember that none of this will happen without the one crucial item that we have traditionally given short shrift to in the past: training. It seems that whenever IT budgets get tight, or whenever something has to be curtailed for whatever reason, it turns out to be training. That isn't going to work anymore, and we have to see training take on a new priority in our striving for excellence.

The new world of computing demands that computer professionals be not only technically talented and up-to-date, but that they also be responsive, cooperative, user-oriented, and able to see beyond just their own concerns. Attitudes such as—software is hard to write, therefore it should be hard to use; or, time spent in non-programming activities like documentation, meetings, and listening to the users is time wasted; or, the more elegant and sophisticated a program is, the better—have to be done away with, and the staff who still hold these attitudes have to be retrained. Their departments and their institutions, as well as they themselves, have to make this commitment.

Okay, so what's the next step? If you think TQM might be important, you may want to take some time to learn more about it. Needless to say, there is a lot more to TQM than just these three components of customer focus, process improvement, and staff involvement. There is a whole range of tools and techniques, statistical analysis methods, Pareto diagrams, affinity charts, benchmarking, and on and on, all of which will be helpful in terms of actually implementing TQM. In fact, George Bateman of the University of Chicago Business School gives a full-day seminar on this as a preconference workshop before the CAUSE and EDUCOM conferences, and from what I understand, the CAUSE staff is planning to make a videotape from that seminar for CAUSE members. There are two or three books focusing on TQM in higher education that are quite good also. You may want to check these out. The first one is called *On Q: Causing Quality in Higher Education*, by Daniel Seymour, published by Macmillan. The second is from the College and University Personnel Association, CUPA, called *Applying the Deming Method to Higher Education*. And the third is published by Jossey-Bass through the Association for Institutional Research; it's called *Total Quality Management in Higher Education*. Each of these books is also loaded with references to other books and publications that will lead you even further into it.

On the other hand, by now you may be thinking that TQM is interesting, but .... You may be also thinking of the reasons that it just isn't going to work for you. Before you make up your mind, I'd like you to consider some of these issues.

First, I know you're already too busy to get into something new. I know the fire-fighting that goes on in IT, and I know the pressure-cooker atmosphere that has developed, especially with shrinking budgets over the last couple of years. But this may be exactly the reason you need something like TQM. At a community college in the midwest that we did some work at recently, after studying some of the problems with IT that the school was experiencing, it seemed to us that the institution lacked a cohesive focus for IT, and that lots of people were doing lots of things, but without the benefit of a strong, unified direction. We suggested that they create a function, not a position, but a function, which would help bring focus to this area. In giving them some of the specifics about what this function would look like, we said that a majority of the time of the person or persons filling this function would be spent among the user community, listening. Unfortunately, most of the people who were currently responsible for providing computing services took great exception to this; one of them in fact said, "How can we possibly spend our time listening? We are already too busy doing." But of course, this was at the very heart of the problem. How could they know they were spending their time doing the right things, if they weren't listening to the users?

With TQM, we've identified a purpose: to serve the customer and to do the work that is customer-focused and customer-driven. In addition, by changing the system, we can build quality into the process, reducing the need for endless checks, double checks, reworks, and throwaways. We can't let the rush of day-to-day work and a fire-fighting mentality allow us to wear blinders forever. I think we need to take the time to step back, remove the blinders, and see what is happening all around us.

The second issue I'd like you to consider is especially for those of you who are stuck on the word "customers," or who don't want to think about TQM because it's too business-oriented, and "after all, we're just a service within an educational institution." I urge you to rethink that position. Consider that it's entirely possible that one of the reasons that information technology departments are not thought of with the highest esteem throughout higher education, and are too often thought of as part of the problem rather than part of the solution, is because we have never had any competition. We have had a captive audience all this time, and this has given us the unparalleled opportunity to be less than excellent. Until we start thinking about running IT the way a competitive business should be run, we are likely to remain in that deadly trap. It is not a coincidence that at the very same time our institutions are questioning the value of information technology, that outsourcing is on the rise.

Third, if you are thinking that no one else on campus cares about TQM, you could very well be right. But that doesn't matter. You can do it anyway. TQM will require an investment in time and possibly in money, but once the investment starts to pay off, others outside of IT will start to care. You can be the ones communicating quality to the rest of the institution. Even the president may be swayed into thinking that IT really does have genuine benefit.

And finally, for those who are thinking that TQM is just a fad, you are probably right. I think the chances of this being a long-lasting set of tools or techniques with this particular set of perspectives is small. Twenty years from now, or even twenty months from now, you may not often hear the words Total Quality Management anymore. But what definitely isn't a fad is what's underneath TQM. The underlying principles of customer focus, process improvement, and staff involvement will remain, and that's what we have to concentrate on.

We should rely on common sense. What could be more sensible that looking at our mission, and focusing on the customer? What could be more right than asking the hard questions that lead us to restructure our systems to serve the customers' needs, and mesh with the abilities of our staff?

Let me just say a few words to wrap up. IT people have the toughest jobs on campus. These words on the slide are from a Federal Express ad, and I think they apply better to IT that almost any other area I can think of. "It's your job not to screw this up or make any mistakes or drop the ball or blow the game. Do it faster and quicker and more reliably and more efficiently. Do it right, first-rate, top-notch, without a hitch, and absolutely flawlessly. Botch this one and you are out of here, history, finished, terminated, toast, lunch, gonzo, dead, kaput. And one more thing, DO IT FOR LESS MONEY than you've ever done it before!"

It's a big, tough job. TQM will not, contrary to what some quality experts may breathlessly assure you, change everything overnight. But its guiding principles will allow us to make some important improvements and to take some important steps toward achieving excellence. TQM is just one set of tools you can employ to help you do that. It is a current set, it is based on some good principles, and it is building up a decent track record in other enterprises. But it is only a tool, a technique, not an end unto itself. Results are what count. The person I quoted earlier, Joshua Hammond, also said, "Excellence is not a program; it's an attitude."

We have to do this. Our institutions are in trouble, and they can't afford us to be one iota less than excellent. Our colleges and universities have, for years, benefitted from your work in the use of technology. Today, they need your commitment to assuring that the technology and the technology services you provide meet the goals of the institution. The achievement of excellence in information technology is an issue that directly impacts the role our colleges and universities will play throughout the next century. In some cases, it may even be an issue of survival.

I'm confident that we can make excellence happen. Thank you.

Cost Containment - Pushing Information Technology Through The Eye of the Needle

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Abstract

This presentation will describe the Administrative Services Cost Containment project that was initiated at Hunter College in March, 1991 and is on-going today. This project's primary purpose is to control the costs of the administrative infrastructure of the college. A serendipitous outcome of the project was that the exhaustive and exhausting discipline of cost containment proved to be an ideal tool for allocating Information Technology resources to the needs of the college. The project should be of interest to anyone that is trying to do strategic planning with shrinking resources. Executives, in the Information Technology and Administrative Services areas, should find this an interesting presentation.

McKinsey & Company, the internationally renowned management consulting firm, provided us with a methodology and PC software to facilitate the earlier phases of the project which culminated in a plan for substantial savings in the cost of the administrative infrastructure. The implementation of the plan started in August, 1992. This paper will describe what was done right, what was done wrong, why this is an excellent way of doing strategic planning for Information Technology and how the entire Administrative Area of the college was pushed through the eye of the needle.

This paper follows the charts that were used in the presentation. These charts are given, in reduced form, on pages 9 to 14 and are numbered from 1 to 26. This paper then proceeds, in 26 sections, to discuss each chart and thereby review the presentation. These reduced charts are difficult to read so if a full size copy is desired, the authors should be contacted.

1 - Cost Containment - Pushing Information Technology Through the Eye of the Needle.

This paper concerns the Administrative Services Cost Containment project that was started at Hunter College of CUNY in March, 1991 and continues today. Hunter is the largest senior college in CUNY with 20,000 students, 1200 full-time faculty and staff and about 600 part-time faculty and staff. The primary purpose of this project was to control the costs of all of the people reporting to the VP for Administration. A serendipitous outcome of the project was that the process produced an excellent method for assessing computer project priorities. McKinsey & Co., one of the premier management consultants in the world, provided us with a methodology, training and software. As the diagram indicates, this paper describes how moving from emphasis on computers to emphasis on dollars produced a move from being part of the problem to being part of the solution. Getting everyone, including the information technology people to adopt this discipline sometimes felt as if I was pushing them all through the eye of a needle.

2 - Looking Back (1988-89)

In 1988, we decided we needed a methodology for setting priorities for computer projects so we formed a committee called the Administrative Information Systems Planning Committee. We had AVPs, Asst Deans and Department heads on the committee and since strategic alignment was in vogue at that time we had one of our professors who was a recognized expert in strategic planning provide us with some first class methodology.

The results were that the first choice - Chemical Inventory - is a great PC system that nobody uses. Facility Management is a solid mainframe system with limited use. The Student Advisement part of the third choice is taking forever to come into being and we're still trying to figure out what an EIS looks like.

It will be instructive to compare the type of systems chosen here with those chosen with the new methodology.

3 - Hunter College Budget

There's no need to spend much time on this chart. The message is that Hunter, like the rest of higher education is in financial trouble. When inflation is taken into account, Hunter Administrative Services is seen to have taken a cut of about 40%

over the last seven years. When this is combined with the additional responsibilities that the area has assumed, it's probably accurate to say that, over the period from fiscal 1985 through fiscal 1991, Administrative Services has produced a 75 to 100% increase in productivity. Yet more was being asked. Clearly a new approach was needed because simply doing more with less could lead to a sacrifice of quality and a real risk that any productivity improvement would not be sustainable for the long run.

4 - The New Productivity Challenge

A brilliant article by Peter Drucker appeared in the November-December, 1991 issue of the Harvard Business Review. The article is titled, "The New Productivity Challenge." It's an excellent overview of what is at the core of many of the new methodologies that are now being recommended to us. Drucker describes scientific productivity improvement as starting with Frederick Taylor in the 1880s doing time and motion studies to dissect each task and concentrate on improving the efficiency of each individual worker on an isolated basis. Fifty years after Taylor, Mayo began distinguishing between effectiveness and efficiency and began an approach that might be characterized as "doing the right things rather than just doing things right." Because of the shift to knowledge and service work, Drucker says that a new way has evolved which consists of defining the task, concentrating work on it, defining performance, making the employee a partner in productivity improvement and the first source of ideas for it, and building continuous learning and teaching into the job of every employee and work team.

McKinsey has taught us an orderly method for doing what Drucker describes and has given us PC software to facilitate the process. Chart 4 summarizes the key phases of that methodology in the column headed McKinsey.

In fact, all of the new methodologies have much in common - which is basically rethinking what's happening. Let's take the next chart as an example.

5 - When you are up to your ears in alligators

The saying here reminds us that we are always caught in the false dichotomy of fighting alligators or draining swamps. The new methodologies and the new productivity challenge is to train the alligators to clean up the swamps.

A question I'd like return to at the end of the presentation is - who are the alligators?

6- How the Process Works

The process consists of six phases laid out along the time line on this chart. Phase 0 is the organizational and initial training. Phases 1 to 3 are to decide how the cost containment will be done. Phase 4 is where sustainability is built by planning the capture of the projected savings. Phase 5 is the implementation of the action plans. Hunter is now in Phase 5.

Some points worth making about this process:

- McKinsey encouraged us to get to Phase 5 in no more than 4 months; we took 17 months.
- A full day's training was given for each of the first three phases. This tied up about 35 people for each day.
- The Steering Committee (President, Provost and VP for Admin) spent many hours on this project during Phase 3. Perhaps as much as 30 hours each within a one month period.
- Enormous burden upon VP for Admin and Project Leader to negotiate ideas and follow up on implementation.

7 - Key Principles

This chart gives the key principles of the methodology. The 40% cost savings target tends to lead to a lot of anxiety as well as good idea production. The next chart looks at the 40% a little more closely.

8 - 40% Stretch Target

The 40% cost reduction stretch target is used to stimulate creativity and generate ideas for fundamental redesign rather than just incremental belt tightening. However anxiety is created by this target. In our case, our President's willingness to enunciate a no-layoff policy and to explain that we would take a multi-year approach to capturing savings did much to alleviate the anxiety.

9 - Project Roles

This chart shows the project organization. The Task Force focused on overall management and "top-down" restructuring by trying to take a cross-functional approach. We divided Administrative Services into 15 units mainly along organizational lines. Unit Leaders were generally first (lowest) level managers. The Next Higher Managers were Directors of departments and for the most part were also the Task Force members. This was not a good idea since it's probably the reason for the Task Force having difficulties in cross functional analysis.

11 - Phase 1 Missions, Activities and Outputs

Each unit develops a complete description of their unit in terms of its missions, activities and outputs. Typically, a unit will have several missions, each mission will have half a dozen activities and each activity will have several outputs. A unit can easily have a hundred outputs. The costs associated with each output are gotten by allocating the unit's budget to each output. PC software, supplied by McKinsey was used to do the allocation and to then roll up the outputs to assign a cost to each activity and each mission. Even with the software, this is a labor-intensive task. An example of a mission, an activity and an output is given at the bottom of the chart.

12 - Missions, Activities and Outputs (MAOs) -Illustration

This is an example of a portion of a MAO listing. We can see that the unit's cost for each mission, activity and output is given. For us, at Hunter, this was very valuable information since it provided a cost accounting viewpoint rather than a fund accounting one. An analysis, using fund accounting, must deal with a unit's costs being spread over several funds using cost categories that have little relationship to what is going on in the unit. Using MAOs, we can actually state the cost of individual activities. This now puts us in a position to assess the costs and benefits of the ideas that will be generated in Phase 2.

One very important result of Phase 1, which many people at Hunter still don't believe, is that the VP for Administration actually controls only about 25% of the budget. Prior to doing this analysis most people thought that the figure was between 40 and 50%. This was due primarily to the confusion caused by fund accounting.

13 - Phase 2 - Summary

By the time Phase 2 got started, the project was 8 months old for some of us and 4 months old for all of the participants. So people were a little cranky when they found that they were to learn new software and take more training. Nevertheless they were asked to generate ideas that would save 40% of their unit's costs. The doughnut in the chart shows the cycle that each unit went through several times. After several cycles and much negotiation with the Project Leader and the VP for Administration, each unit produced many ideas and classified them as go, no-go, controversy and further study. Hundreds of ideas were produced and these were discussed with the Steering Committee.

14 - Expense Reduction Idea Generation Tree

McKinsey recommended this tree as a source of ideas for reaching the 40% goal. It is interesting to note that the iterations tended to start with improving efficiency - the lower part of the tree and moved in later cycles to the upper part of the tree which is the more modern approach.

16 - Form 2B Idea Evaluation

This is the form - one for each idea - that was reviewed with the Steering Committee. Although you can't read the details of the form, the general content is what is important. This form which is produced by the Phase 2 software contains a description of the idea, the benefits, adverse consequences, implementation considerations, comments by all of the players and, at the bottom, the expected unit savings as well as other unit savings. There's also some bookkeeping columns to prevent double counting of savings.

On the right middle of the form are the start-up costs and the payback period in one block. And in another block, on the right, each of the players gives a risk assessment and the status of the idea (go, no-go, controversy, further study).

I think that one would have to agree that this is a very complete and concise presentation of an idea.

17 - The Twenty-one Most Costly Activities

What are some of the results of doing Phases 1 and 2? First, the cost accounting approach of Phase 1. This chart shows the 21 most costly activities and gives the FTEs used and the total cost. These 21 activities account for about 50% of the Administrative Services budget. We have similar lists of the most costly activities for each unit. This kind of information is an excellent management tool and an excellent start for an idea generation session. For example, do we really need five people to maintain temperature control? Are there really 11 people in Custodial Services working on improving the quality and effectiveness of the unit?

18 - Examples of Ideas Not Involving Information Technology

What about the ideas generated in Phase 2? This chart gives some example of ideas that don't involve Information Technology and are broader in scope and controversial. The asterisks indicate which ones have been adopted. Those that were not adopted are either very controversial or have political overtones that go beyond Hunter.

19 - Examples of Ideas Involving Information Technology

On this chart almost all of the ideas have asterisks. Clearly, this type of idea was more readily accepted. The key operational principle here was that the units were willing to negotiate a contract. They were willing to save dollars if they actually got something in return that made their life easier. Usually the easiest things to give them was technology or permission to change the service. Notice how often the word "eliminate" appears. It's worth mentioning that when these ideas were presented to focus groups consisting mainly of Deans and Chairs, their response ranged from "these ideas are obvious" to disinterest and even anger. To those who felt the ideas were obvious, our President directed the question of why no one had suggested them before. The disinterest and anger, I attribute to first, our not involving more Deans and Chairs in the Task Force and second, to a general lack of interest on the part of the Faculty in Administration's problems. And that's not completely unreasonable! Why should be they be interested in those kind of problems?

20 - Phase 3

This is the decision making phase where all members of the project team present the ideas to the Steering Committee. The major point here is that each Idea Evaluation (chart 16) is presented to the Steering Committee and they decide on its disposition - go, no-go, controversy or further study. Presentations of technology are to be avoided. Since each unit had many ideas to present, the best approach was to give the Steering Committee an overview of the more obvious go and no-go decisions and let them concentrate on big ticket items and on those ideas classified as controversy or requiring further study.

This process highlighted the need for more staff training in planning and presentation skills.

21 - Phase 4

By the time we got to Phase 4, everyone was about a year into this project and very tired of it. Remotivation was needed at this point and it had to be done at the highest level. An action plan was made for each idea. This was a one page simple document that said what was going to be done, what were the prerequisites to getting it done, who was responsible and how much would be saved. In essence a negotiated contract.

A trap that the Information Technology people have to be wary of is that they may be so happy about having a meaningful conversation with users that they go ahead without the contract.

The stage we're at today is the beginning of Phase 5 - implementation of these action plans. Let's look at some of the expected results.

22a - Schedule of Captured Savings

This chart shows the savings that we expect to capture for all of Administrative Services. The vertical scale is millions of dollars. The annual savings for the five years from fiscal '92 to fiscal '96 are shown as the right- most five bars. In fiscal '92, there were $95,000 saved, in the current fiscal year, $1,600,000 is being saved and in fiscal '96, there is to be $2,500,000 saved. The cumulative savings captured over the five years are expected to be $8,000,000 which is 47% of the fiscal '91 administrative services budget (left bar on the chart). The start-up costs are the three bars centered on the number 5 in the chart and they are $400,000 in fiscal '92, $250,000 in fiscal '93 and $40,000 in fiscal '94. The bars marked 2 and 3 indicate that the maximum annual potential savings are about $2,900,000. The bar marked 4 indicates that there is a potential savings of about $1,000,000 from units outside of administrative services. This last amount has been extremely difficult to capture.

23 - Comparison of Potential Annual Savings to Captured Annual Savings and to Start-up Costs

This chart shows a quadruple set of bars for each unit. The vertical scale is thousands of dollars. The first bar is potential annual savings, the next two are start-up costs for fiscal years '92 and '93, and the fourth bar is the annual captured savings. Thirteen of the fifteen units are projecting that they will capture almost all of the potential savings. Only four out of the fifteen have start-up costs that are significant with respect to the captured savings. However, if we consider the total for all units, the cumulative start-up costs are only 8% of the cumulative savings. Even if the start-up costs are 50% higher and the savings are 30% lower, the numbers still look very good.

24 - Potential and Captured Savings

This chart shows the potential and captured savings, as a percent of total expenses, for each unit and for the total of all units. While the total potential savings was a little more than 15% and the captured was 13.4%, there were several units that did much better. One unit actually achieved the 40% stretch target and four units reached targets above 20%. Unit G, which was very resistant to the whole project, nevertheless reached a target of 17.5%. Maybe the 40% stretch is not so crazy.

25 - Summing-Up

This chart sums up where Hunter is at now. Cost containment can work and it's a big help in setting priorities for Information Technology but it takes a great deal of effort and dedication. Whether we will reap all of the projected benefits remains to be seen and maybe we can examine that at next year's CAUSE convention.

Last, who are the alligators that we have to train to drain the swamp?

26- The Computer Alligator

The alligators, of course, are everyone in Administrative Services. "We have met the enemy and they are us." The faculty and the students are not the alligators who are nipping at our ears. What they want is low costs, high quality, great service, no problems and continuous improvement. This means that they behave like customers. Our problem is to train ourselves to give them what they want and to make use of technology to accomplish that end.

Opportunistic Planning for Information Technologies: Upside Down or Downside Up?

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INTRODUCTION

Liberal arts colleges often have difficulty justifying an investment in information technology (IT): they do not have the technology curriculum which requires a substantial hardware and software investment and they are not large enough to require significant information systems merely to successfully administer the school. As such, opportunistic planning strategies (identifying non-technology goals of priority concern to the school for which information systems investments can be justified) are frequently the only way to build the information systems infrastructure.

In this presentation the experiences of two liberal arts colleges that utilized opportunistic planning are compared. One institution began with a formal institution-wide agreement, including faculty, senior administrative officers, and trustees, that information technologies could be used as a primary strategy to accomplish essential non-technology goals. The other institution began with an information systems familiarity component of a new core curriculum, and relied on individuals involved in technology operations and key faculty to lead the college's implementation efforts due to the virtual absence of high-level advocacy.

Planning Strategies

Information technology planning is typically seen as a formal process in which the first step must be to have the institution commit to some form of a technology future for itself. The reasons for such planning are many and various (see Badagliacco, 1992; Coopers & Lybrand, 1990; Johnson, 1989; Boyer, 1987; Ferrante *et al*, 1988). These reasons argue for formal planning for IT in higher education institutions. "Formal" planning connotes adoption of a process with responsibility for planning assigned to a committee of faculty and senior administrators. Planning follows a traditional model with its roots in the corporate sector -- whether it be long-range planning, strategic planning, reactive planning, budget planning, or a mix of these -- and a series of defined steps (as described by Cope, 1987 or Bryson, 1988, for example).

In simplest form, such planning begins with the institution's mission, followed by identification of strengths and weaknesses, development of assumptions about the future, development of a vision of the future and goals consistent with the institutional mission, development of a timeline for achieving these goals (and specific timelines for implementation of various steps along the way), and a provision for assessment and feedback on the plan's progress.

Opportunistic models recognize the limitations of these traditional approaches to planning in higher education, namely, that the products of traditional approaches to planning are often just that -- traditional. Liberal arts institutions by virtue of their limited resources cannot be everything to everyone; thus, they first and foremost must identify and create a distinctive and coherent identity for themselves, and implement programs and initiatives, including those for IT, to establish and reinforce this identity. In opportunistic planning, people seek to identify and implement interesting programs that are likely to attract student (and other) interest in the college and that are related to overall institutional purposes. Opportunistic planning, however, runs the risk of creating a range of individual initiatives -- including IT ones -- which, although related to an overall institutional purpose, are not coherent with each other. Such instances point to the importance of a clear vision for the role of IT in the college. This is not simply in terms of educational purpose, which is the primary reason for IT in a liberal arts environment, but to maintain perspective and provide for the allocation of limited resources to appropriate IT initiatives. Ideally, this sense of need comes from within the campus community and is championed by the president of the institution with the support of trustees and other senior administrators.

Liberal Arts Colleges

Liberal arts colleges' experience with planning for IT following either traditional or opportunistic models is limited. Data on CAUSE member liberal arts colleges illustrates this point: of the 123 liberal arts institutions that are CAUSE members, 57 have a plan for IT on their campuses. Further, only 38 have included IT as part of their institution's strategic or long-range plan (CAUSE, 1992).

While it is altogether possible that IT planning has not occurred at some institutions due to a lack of resources to undertake any IT initiatives or projects, another reason for lack of any planning for IT may be that institutions simply do not know where to start since they are faced with a range of choices of planning processes (see Falduto, 1992 for a discussion of these alternatives). Further, planning is thwarted by the fact that models for both planning and technology implementations which worked in larger, research or technical institutions, may not be appropriate for a liberal arts environment. It appears that successful IT initiatives in liberal arts colleges -- those considered to have positive impacts on teaching and learning, that provide access, and where use is encouraged -- emphasize consideration of institutional characteristics and trends (including culture), the potential usefulness of the technology, and users' characteristics. In other words, knowledge and understanding of people (individually and as the institution) and conscious consideration of how technology can be effectively used (a purpose) are important ingredients in an IT implementation which has positive impacts on teaching and learning. Further, this approach leads to the perception that faculty, students, and staff are being supported in their desire to employ IT tools in teaching, learning, and educational program support activities (Falduto, 1992).

Both of the institutions involved in today's presentation began with a goal of furthering the use of IT within their respective liberal arts environments. Drew University began with a formal institution-wide agreement, including faculty, senior administrative officers, and trustees, that information technologies could be used as a primary strategy to accomplish essential non-technology goals. Hartwick College relied on individuals involved in technology operations and key faculty to lead the college's implementation efforts due to the absence of an institutional technology plan.

Drew University.

Drew University is an independent university of 2,100 students including an undergraduate college, a theological school, and a graduate school whose setting is a 186-acre wooded estate in Madison, New Jersey. Once described as "militantly liberal arts," Drew has a reputation for innovation in higher education, and its emphasis on "technology in service to the liberal arts" is one of these innovations. Indeed, Drew University has demonstrated that a university need not be a large technical nor research institution to effectively employ IT in its educational program. Drew's pervasive IT infrastructure provides PCs for every student, faculty and staff member, a campus-wide voice/data/video network, telecommunications services and voice mail, library automation, electronic mail, a campus-wide information system, access to academic and administrative computing centers, and access to Bitnet and the Internet.

Hartwick College.

Hartwick College is a selective liberal arts undergraduate college with 1,500 students and 115 full-time faculty members. The college is located on a 375 acre campus in upstate New York in Oneonta. The college has a well articulated general education requirement titled Curriculum XXI which was instituted in 1988. Curriculum XXI is premised on the simple fact that those students currently entering Hartwick will spend nearly all of their productive careers in the twenty-first century, and Hartwick wants them to be ready. Clearly a major component in the preparation of students for the twenty-first century is an environment which promotes the use of information systems (IS) in accessing, processing, critically evaluating and disseminating information of all forms from and to myriad sources. IT at Hartwick has been implemented through a series of carefully planned and negotiated stages, and although implementation efforts continue, most faculty have PCs, students have access to PC and Mac labs, a fiber optic network provides faculty, administrators, and students with access to academic and administrative computing resources, electronic mail, library automation, and the Internet.

CASE STUDIES

Drew University: Pervasive IT through Institutional Initiative

The pencilled line across the quadrille-ruled paper told the story. Was it merely another yet-to-be-proven prognostication by those university researchers? Or, had Drew University held the demographic declines of the early 1980s at bay long enough, and it was clearly time to confront the challenge?

Opportunistic planning for IT at Drew University is indeed an example of the "upside down" variety. Faced with a projected decline in first year student enrollments through 1995 that would shrink Drew's College of Liberal Arts from 1,400 to 900 students, the university stood firm in its "commitment to an idea (the liberal arts for us)," as the Dean of Drew's College of Liberal Arts wrote at the time[1], and "ventured to the outer edge" by implementing distinctive programs which strengthened Drew's position against its competitors.

Drew University seized the opportunity of the demographic declines of the 1980s to:

- *strengthen its position against its competitors*
- *exploit the strengths of its liberal arts program*
- *develop a series of related, dramatically innovative programs*

Planning for IT during the 1980s was based on these overall university strategies. However, a philosophy stemming from the purposes of liberal education and recognition of the potential for IT in support of these purposes guided Drew's efforts. In sum, given that the fundamental goal of a liberal education is to teach people to think and that a liberally educated person systematically, logically, and creatively assesses available information, Drew chose to focus on the integrated use of computer and networking technology to access, process, and communicate information. The goal was not to make liberal arts students technologists, but rather, to make them capable, thinking people who can make use of technological tools in their everyday lives.

Specifically, the objectives of Drew's technology initiatives were:

- *to provide access to IT resources (initially personal computers and software), and*
- *to provide access to knowledge and information through a sophisticated campus-wide voice/data/video network.*

Information technology planning and implementation followed a consensus-based approach which involved hundreds of faculty, administrators, students, staff, and trustees. With the authorization of Drew's Board of Trustees, Drew's senior administrative officers, recognizing the importance of IT in a liberal arts environment and the opportunity to advance Drew towards achieving its strategic goals, encouraged the campus community as it undertook two major IT initiatives: the Computer Initiative (1983-84) and the Knowledge Initiative (1987-88).

The Computer Initiative

While ***Time*** was recognizing the IBM PC as the magazine's "Man of the Year," the Drew faculty was sensing the impending "information age." Acknowledging the importance the computer was beginning to assume in almost every aspect of life, the faculty redefined "liberally educated" to include the use of the computer as a tool -- the PC would be an important tool for learning, and it would be important for an educated person of the future to be "computer fluent." The first evidence of this took a traditional form: a computer literacy requirement, the purchase of PCs for some faculty and the central academic computing center, and the creation of a computer science major.

During the summer of 1983, the university researchers (two psychology department faculty members) proposed a program called "Countless Computers" as one possible response to the impending demographic doom. The dramatically innovative program, later to be officially known as Drew's "Computer Initiative" ("CI"), had surprisingly few technological objectives. Viewed as a prime opportunity to counter the demographic decline and build Drew's reputation, the CI was expected to:

- *increase Drew's applicant pool and yield (estimated 40 to 50 additional enrolling students per year)*
- *attract more academically qualified students*
- *increase net tuition revenues (to cover cost of computers and financial aid) as cost of computing equipment declined in the future (increases in tuition at Drew at the time were tied to specific improvements in educational opportunities)*
- *give Drew national attention (as the first liberal arts college to provide its students with computers outside contract or required purchase programs)*
- *introduce word processing and improve writing*
- *have advantages in "hard" and social sciences*
- *enable Drew to drop its general education requirement for computer science course.*

The success of this program depended on:

- *making computers available to all faculty and staff who wanted them*
- *students and faculty previous experience with computers (which was positive from the university's providing a limited number of personal computers in 1982)*
- *that this type of equipment would not turn into "a dead end" within the next few years.*

With the enthusiastic support of the faculty and senior administrators, Drew's trustees authorized the CI program. The enthusiasm permeated subsequent implementation activities as task forces of faculty, students, and administrators tackled issues of student access, student ownership policies, what personal computer to issue, security measures, training, dorm furnishings, locations of PC clusters (for sophomores, juniors, and seniors), curriculum development, and upgrading the central academic computing system.

Computer Initiative Implementation.

- *1984 - First CI funded desk top computers and software provided to incoming class, faculty and administrative offices*

The CI set a standard for hardware and software on campus. Drew could now support this package 100% with training, documentation and a no cost hardware warranty as long as the student was enrolled at Drew (excluding user damage). The overall CI plan considered the amount and type of staff needed to make it work. Students also would play a key role by working the help desk and within offices supporting the technology on campus

- *1985 - CI funded computer package is rounded out with the inclusion of a personal printer*

One printer per room was provided the first year of the CI. Unlike the computers which the students owned, many of the printers were abused. We learned that ownership plays a key role in how the equipment is maintained and treated.

- *1988 - First CI funded portable computers provided to incoming class*

Drew took a bold step with its plans to provide portable computers since at this time they were not considered "real" computers. The portables traveled to class, training sessions, the lab and were used under the Drew oak trees. Student and faculty reaction to the Zenith dual floppy system and "portable computing" was extremely positive. So much so we've continued to provide a portable computer.

- *1990 - The Drew Graduate School decides to join the CI*

The success of the College of Liberal Arts CI program and the belief that graduate students could benefit from this program convinced the Graduate School to join the CI program.

- *1992 - First CI funded notebook size computers given out to the incoming class*

The package consisted of a Digital equipment 386sx notebook with 2400 baud modem, 2mb memory, 52mb hard drive, Epson printer, Wordperfect 5.1, Quattro Pro (AE) spreadsheet and other software utilities.

The Knowledge Initiative

The planning and implementation of Drew's next logical step -- the connecting of the 2,000 personal computers on campus to information resources -- built again upon the philosophy and purposes of IT at Drew. The opportunity to implement another innovative program in the case of Drew's "Knowledge Initiative" ("KI") was provided by a second round of demographic declines, the community's desire for a library automation system, and an obsolete and inadequate telephone system.

In 1987, two planning activities were occurring simultaneously. In the first, the campus community was undertaking a capital campaign needs assessment. In the second, administrators were considering alternatives to an obsolete telephone system. The initial outcome was that Drew would replace its telephone system in the near term, and in the longer term would install a campus-wide network and library automation system. As bids for a new telephone system were reviewed with vendors, it became apparent that Drew had an opportunity to not only replace its telephone system, but to install a campus-wide communications system and data network. Again, Drew's senior administrators enthusiastically backed the project, and enlisted the support of Drew's Board of Trustees as well as corporate partners for the project.

Drew recognized the importance of an active and on-going relationship with IT vendors to develop system enhancements appropriately and keep the system reasonably current for the longer term. Practically, Drew could not afford to be supporting the needed development activities alone but wanted vendors who would be willing to use our system as a location to cooperatively develop and test software and hardware. Thus, Drew sought vendors for the project who were interested in forging a partnership with each other and a liberal arts institution to demonstrate not only the application but the importance of IT in a liberal arts environment.

Knowledge Initiative Implementation.

- *FALL '87-WINTER '88 - Approval of project and selection of consultant to help in the RFP process and vendor selection*

- *SPRING '88 - Vendors selected*

- *SUMMER '88 (10 weeks) - Installation of Intecom PBX, Octel voice mail, fiber optic cable, VAX network server, cabling, telephone billing system, phones & data devices begins*
  Student programmers put together network system menus and wrote the many network programs. This provided the students with tremendous learning experiences and let them feel the network was from them, not thrown at them.

- *FALL '88 - Systems up and working. Hand out about 1,800 phones to all students with documentation and training sessions scheduled*
  Voice mail was an instant success with students. E-mail took longer to catch on but typically a faculty member would send a homework or lab assignment via e-mail with a notification of the assignment sent via voice mail.

- *FALL '89 - New features added to the Network system including library automation (DRA), Internet access. Efforts started to provide more on-line information.*

- *SUMMER '90 - Broadband Cable System Installed*
  The campus was wired with broadband cable with over 1,000 cable outlets in residence halls and classrooms. Four satellite dishes were installed for reception of SCOLA, CNN, C-SPAN, ESPN, MTV. Drew Movie and educational channels established for educational and entertainment broadcasts.

- *FALL '92 - Network System officially becomes a Campus-Wide Information System* with on-line services including a calendar program for Drew events, budget reports, campus directory, committee reports, class and final exam schedules, office hours, software and documentation distribution, newsletters, TV listings, Drew Catalog listings, and Human Resource policy manual

  Voice mail system now offers job listings, baby sitting service, directions to the Drew campus, voice mail forms mailbox used to order computers, snow closing and other emergency information, and other information mailboxes (office hours, weekend events).

Impact of the Computer & Knowledge Initiatives

What impact did these "countless computers" and campus-wide network have on the traditionally liberal arts Drew campus? Applications for admission increased by 42% (and have remained at that level despite a shrinking pool of applicants and increased competition for students), entering classes increased by approximately 40 students, and combined with other activities the average total SAT of entering students increased approximately 125 points as well. The use of these personal computers and the voice/data network is overwhelming. Faculty, students, and administrators believe in the value of these IT tools, and use has become routine -- so much so that "people were about as excited about PCs as they are about chairs -- they are absolutely essential but unworthy of too much attention" (Mills, et al, 1988). Educationally, four out of five graduating seniors report a high level of satisfaction with Drew's computer services and facilities, and one out of two reports that his or her undergraduate experience has greatly enhanced his or her ability to use quantitative tools (Drew University, 1991). And the Computer and Knowledge Initiatives continue to attract students to the Drew campus: admitted students for fall 1992 gave these programs the highest ratings as a distinctive feature of Drew (Drew University, 1992).

Hartwick College:
Grass Roots Opportunistic Planning

As noted earlier, Hartwick had instituted a new curriculum which had the avowed goal of preparing students for the twenty-first century. Mastery of information systems (IS) technology was not explicitly included in the new curriculum, but was implicit both in the science and technology portion of the curriculum as well as in its stated goals. During the period in which the new curriculum was developed and implemented reports critical of the IS component of the college were issued both by a private consulting firm and the college's accreditation association. The combination of the new curriculum and the two critical reports promoted a receptive political climate for revamping of IT at the college. Implementation of an IT upgrade path would address a major criticism contained in the college's accreditation report as well as tangibly demonstrate support for the new curriculum.

At that point, three and one-half years ago, computing at Hartwick consisted of a nine-year old IBM 4331 connected to a laboratory containing twenty-six VT terminals, a laboratory of 26 dual floppy PCs, and a laboratory of 26 Macintosh + computers. The only networking capability was a primitive Janet network in the PC lab. Less than five percent of the faculty had PCs on their desks. The administrative computing system was an IBM System/38 of which major components had been donated by a local bank in lieu of scrapping them after an upgrade.

The Opportunities

A small group of faculty on the Academic Computing Committee realized that constant, active advocacy at the faculty level was the only means by which change would occur. Taking advantage of the political climate created by the factors previously mentioned, this committee convinced the administration that support in implementation of IT was critical at this point in Hartwick's history. Monies were made available from a reserve fund to update the mainframe and its associated laboratory. Just after requests for proposals (RFPs) were solicited from vendors, the Director of Computing quit with no notice whatsoever. Ironically, this became a crucial factor in widening the opportunity structure to the degree that has led to our successful implementation of wide-scale IT on campus. The lack of a "gateway," in the form of a Director of Computing, between computer advocates and senior administration created a climate of creativity and opportunism that would have been otherwise stifled.

In order to maintain forward momentum, a troika was formed among the Director of Academic Computing, the Chair of the Computing and Information Sciences Department, and the Chair of the Academic Computing Committee. Each brought different forms of expertise which allowed for an efficient and very effective division of labor. The two technologists focused on ascertaining and implementing the "best" and most cost effective solutions for the college. The Chair of the Academic Computing Committee, a sociologist, focused on garnering political and fiscal support from senior administrators as well as on long-range planning. In essence, this troika became the driving force in implementation of IT at Hartwick due to the virtual absence of high level advocacy. Its success was due to detailed planning, the appeal of the vision of IT as it related to perceptions of quality at the college and a political strategy that was simultaneously very aggressive yet sensitive to the fiscal state of the college.

The process of seeking and receiving funding for each project was essentially idiosyncratic and outside the normal budgeting process. Senior administrators were "sold" on the merits of each project and, then, monies were "found" to proceed with them. As Pennings (1975) notes, an organization's environmental uncertainty can lead to decision making structures that are decentralized rather than formalized, opening the potential for opportunistic planning structures. In Hartwick's case, the environment is that of selective liberal arts colleges and the uncertainty stemmed from the competition engendered by the demographic shifts of the late 1980's.

Actual implementation has proceeded in five distinct stages to date. Due to lack of any long-term implementation plan for IT, each of these projects had to be developed and funded as separate entities. Further, approval for each stage of development came under widely varying sets of circumstances, depending on the parties involved and current fiscal conditions at the college. Each project had a specific goal and a budget which merely reflected the specificity of each project's avowed purpose. Hence, any planning for system integration and institutional upgrade paths could only be an implicit part of each project. It was up to the parties implementing these projects to insure compatibility and flexibility for future upgrades while maintaining separate financial accountability for each project.

To illustrate how dramatic strides have been made in the introduction and use of IT at Hartwick College on a project by project basis using this methodology, we describe each stage in the following section.

Stage One (Summer 1989).

The first stage was to replace the IBM 4331 with a mini-frame and PC lab to support faculty research and existing classroom and computer lab applications, allow for additional and more sophisticated applications, act as a network server, and improve student access to current PC and miniframe technology. Midway into Stage One it became obvious that there would be glaring differences between the new PC lab and the old, which was located in a different building. A supplemental proposal was developed demonstrating the feasibility of updating the old lab of 8088s served by an XT to a level of comparability with the new lab which would contain 386sx PCs. After receiving approval in the face of some opposition, we chose to serve this updated lab off of a new VAX 6410 via a fiber-optic connection. This connection became the basis and rationale for establishing a campus-wide network.

Stage Two (1989-90).

During the 89-90 academic year the inadequacies of the administrative computer (IBM System/38) became unsurmountable in a cost effective manner. There was a dramatic increase in requests for data processing capabilities far beyond what the system could handle. This led to an upgrade to an IBM AS/400 as well as the introduction of token-ring networking for some administrative offices.

Stage Three (1990-91).

Plans called for implementation of an automated library catalog in the 92-93 school year. A proposal was advanced suggesting that more rapid installation of such a system would prove beneficial for the college given the increasing competitiveness of small selective liberal arts colleges. A capital campaign had just been launched and, after considerable lobbying, this was one of the first projects that capital campaign funds were released to fund. A key part of the library system was demonstrating the increasing value of a campus network as a significant component of an education at Hartwick. The library system was installed during the 90-91 academic year.

Stage Four (1991-present).

Hartwick was planning a new academic building to open by the fall of 1992. Although initial plans called for the facility to house academic computing, the whole issue of networking was only peripherally dealt with by those most involved in planning the building. During the early months of 1992 several meetings were held suggesting the value of extensively networking the building as a demonstration of how the whole campus should, and could, be networked. To achieve this, we had to include the cost of networking in the capital costs of the building. Further, to acquire additional staff to assist in implementation we had to include a personnel line for a network manager as part of the capital costs of the building rather than a regular personnel item. Currently we have yet to complete all the goals contained within stage four.

Stage Five (in progress).

The final stage constitutes expansion of networking to a dormitory, an additional academic building, and the student center. Current funding allows us to fully connect the dormitory, provide limited connections in the academic building, and run the cable to the student center.

The Outcome

By emphasizing the implicit goals of a series of distinct computer acquisition projects, particularly those goals dealing with network connectivity, a troika of middle-level faculty and administrators succeeded in laying a substantial foundation for a campus-wide network at Hartwick College, in placing personal computers on virtually every faculty desktop, and in providing up-to-date public access personal computer laboratories connected to midrange academic, library and administrative servers.

Because of a strict mandate that no project be allowed to go over budget, the college has benefitted from a number of cost effective measures, including limited use of outside contractors. By performing most of its own work, the college has built many new skills into its full-time maintenance and computer center staff. Long-term support is made considerably easier when the maintainers were also the installers and are thus intimately familiar with the workings of the entire network.

The explicit goals of various stages of building the network have focused on hardware needs. Long-range strategies and mission impact have been buried in the implicit goals. As such, the impact of the computing facilities on the college mission have only been sampled casually. Recent first-year seminars have introduced over three-quarters of entering students to computerized word processing. The new IT facilities and "User-Easy" interface have made one hour introductory sessions feasible and sufficient to start new students using Hartwick's computing facilities. The assigning of permanent student accounts has allowed all students to use computing resources for any class and computer lab usage counts have shown dramatic increases.

In summary, computing at Hartwick College started out as an activity strictly limited to a few computer science and similar courses as well as a limited research tool for faculty. There was no massive groundswell of demand that IT be implemented on a large scale. Yet the completion of each project fueled an ever increasing demand for access to hardware, software, and networks by students, faculty, and administrators alike. This ever increasing demand had consistently paved the way for cross-campus implementation of IT. Stages four and five are not likely to be completed until the end of this school year. With the uncertainties of a new president, albeit one who appears dedicated to proliferation of IS on a large scale, future development and expansion of IS at Hartwick College, no matter what direction it takes, will be predicated upon a system that was incrementally developed with the express goal of maintaining maximum flexibility for the future.

PUTTING IT ALL TOGETHER

Both Drew University and Hartwick College made use of opportunistic planning strategies for IT. Drew, based on its institutional positioning and admissions needs, committed to IT with a formal institution-wide agreement. This was a proactive strategy which required that people be "sold" on the notion that the institution would be stronger (a higher education leader and more attractive to students) if a major IT implementation was undertaken.

Hartwick, with no mission-related need for IT, instead began with the identification of specific technical needs (e.g., update equipment to lower costs; link two buildings for computer access; etc.). This was a reactive strategy in which people reacted to specific frustrations which could be solved by technology. The implicit goal of a broader IT implementation was accomplished through shrewdly including as much additional functionality as possible within the contexts of the specific technical need.

Both of these strategies are viable, depending on the unique opportunities represented in an institution. Each method has advantages. The advantages of the approach with institutional commitment include:

- *major campus-wide implementations are possible*
- *total costs are lower*
- *connectivity/compatibility problems are minimized*
- *the institution is better positioned competitively*
- *it is easier to justify the additional staffing required to fully support implementations*
- *it is easier to get significant vendor support for current and continuing needs*

The advantages of the approach without institutional commitment include:

- *equipment selection and installation is simpler because projects are more technical in nature and small*
- *it works within the annual budget*
- *it has a lower first-year cost*
- *it is possible to use current staffing for installation because the projects are smaller and more focused*
- *it doesn't require moving the entire organization to support IT*
- *it doesn't require a new president*

Two final observations are worth note. First, both strategies require a champion--a person (or persons) who will take upon him/herself the responsibility to make it all happen. Without this, little is likely to happen. Second, the way one evaluates the success of the implementations is different. With the institutional planning commitment, the question to be answered is: "Is the institution's mission being fulfilled better by the implementation?" When there is no institutional commitment, the questions to be answered are: "Is the technical problem served?" and "Does the technology work?"

"Upside down or downside up?" -- the answer depends on the challenges facing the institution. Either way, the first step in planning for IT in a liberal arts environment must be a thoughtful decision as to the purpose of IT for the institution, not just an assessment of the institution's current technological status. Unless the liberal arts institution aspires to become more like the research and technological institutions, it is likely that this purpose will be derived from the fundamental goal of a liberal education, which is to teach people to think. The IT implementation, then, will focus on the integrated use of computer, video, and networking technology to access, process, and communicate information with the goal of making our students capable, thinking people who can make use of technological tools in their everyday lives.

Notes:

[1] Robert K. Ackerman, (former) Dean of the College of Liberal Arts, Drew University, memo to CLA faculty, December 7, 1983.

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TURNING THE VISION INTO REALITY

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ABSTRACT

The VISION was the easy part...what was the role that information technology (IT) could play in supporting the University's mission? The vision is an exciting depiction which no one can argue with--and no one can implement. Plans, however, are implementable. How did we get from the Vision to the Plan? Our vision included eliminating 7 operating systems and our mainframes, networking the remainder of our campus, establishing a standards-based environment, running administrative applications on Unix® workstations, and reducing the percentage of institutional funds spent on IT. This document is not a tutorial on planning, but will generally describe the process and outcomes of translating a vision into a plan and into reality. It then focuses on specific impacts that implementing the plan has had on staff, budgets, productivity, management, and the computing and communications environment. Much of the information presented will relate to administrative computing and networking issues.

The Vision:

Have a vision as your starting point. A vision is continuously shaped by new needs and new technologies, by evolving standards and applications, and driven by the imagination and practical experience of the entire institution. Our vision in the mid-1980's was brought to life with the decision to expand our computing (in those days we just called it computing) infrastructure to include large numbers of university maintained microcomputers (over 600), a digital PBX, a campus-wide data network, and a campus-wide information system. The information system included electronic mail, bulletin boards, library catalog, file transfer, and site-licensed software products for word-processing, spreadsheet, graphics, and communications. We provided low-speed (9600 baud) access from every office, student residence, classroom and lab on campus. Many looked upon this as quite a dramatic change in environment, but we recognized that this was only the beginning.

The change in our infrastructure in the mid-80s provided an environment which fostered positive changes in campus communication and access to technology. Literally, no part of campus life was left unaffected by the use of the campus network and information system and by the availability of microcomputers. We saw clearly how a general change in infrastructure could lead to a whole range of changes in the use of IT. We realized that providing the environment was sufficient to cause specific reactions. And, we might be able to control those reactions by carefully planning that infrastructure. So our new vision would carefully consider infrastructure.

The Beginning of a Plan:

For many years, Lehigh University departments have been producing annual progress and priority statements. Departmental plans are aggregated to produce a university-wide document. With the emphasis on annual planning, we did not create longer-term plans. While we had a tight grip on the vision, we produced no long-term comprehensive plan to support it.

Several things occurred that changed the way we developed plans. First, as funding tightened, it became almost impossible to initiate and finance IT projects in a one-year time frame. Greater lead times and longer amortization schedules were required to fund new projects. Second, reallocation of existing budget dollars became the primary source of new funding. Each vice-president was responsible for funding most projects with monies already available in his or her respective stems. In this process, IT lost money to other priorities. Finally, our Computing and Communications Visiting Committee reported that a long-term comprehensive plan for Computing and Communication

Services was essential to ensure effective management in the coming years. Thus, the first comprehensive plan for computing and communications was initiated.

The Planning Process:

The vision as we perceived it was to use information technology to support the instructional process, research activities, and the business and administrative activities of the University. Translating this vision into the beginnings of a plan, we set three broad goals:

(1) Provide desktop, public-site, and classroom access to all computing and information resources on campus and to similar external resources, especially those available on the national internet.

(2) Provide necessary computing and information resources to enhance personal productivity, and to improve education, research and the administration at the University to ensure that Lehigh remains a competitive educational and research institution.

(3) Provide sufficient support to enable the user to simply, effectively, and efficiently utilize available computing and information resources.

The planning team consisted of the Assistant VP for Computing and Communications Services, the Director of the Computing Center, and the Director of Administrative Systems and Telecommunications. Overcoming the inertia of inactivity and indecision was difficult. We had never done this, so starting was no simple matter. The CAUSE Library had several plans available which served as our guide to the format and language of our plan. We used these plans as a model. The next step was easy. We sat down and made it up. We blended our experience and the experience of others with a reasonably good understanding of the current and emerging technology. The purpose of our plan became, then, to *develop the infrastructure needed to support the probable future computing environment*. There was little input from outside the organization, and not much more from within. The entire process took less than one month. Although, it was a very busy month.

The final task was to plan for evaluation and acceptance. We already had top management's support to develop the plan. Since the planning process included very little outside influence, we now wanted to develop consensus. The plan was shared directly with the president's council and the provost's council. These groups include all of the top management of the University. Further, each faculty member and each administrative department head was encouraged to comment. Finally, each of the

Computing and Communication Services advisory committees was asked to review the plan and make comment.

We braced ourselves for a protracted period of plan review, critique, and rewrite. It never happened. We received minimal critical feedback. Most everyone understood the plan and liked it. We immediately started to focus our actions through the strategies, tactics, and programs of our plan.

Contents of the Plan:

The plan is mainly about creating an appropriate computing and communications infrastructure. In addition, the plan describes the services and support available, and the process for administering and financing the plan. Most of the plan deals with a macro view of information technology, however, it does consider some specific application needs.

Target Infrastructure

The target infrastructure described in the plan is comprised of four major components: (1) a campus-wide high-speed network, (2) a distributed computing and information environment, (3) computing and information standards, and (4) campus relational database technology.

The plan call for the extension of the *campus-wide high-speed network* to all academic buildings and laboratories, administrative offices and campus residences. This network is a fiber optic backbone which is intended to bring high-speed connectivity to the desktop. Network access is described in the plan as an information utility, much as we describe telephone, electricity and water systems.

The plan sets forth a *distributed computing and information environment* consisting of resources ranging from high-end compute and file servers to desktop computers, all readily accessible through the network. In the past most computing requirements, ranging from the most demanding to the most elementary, were provided by individual mainframe computers. The focus now would be on powerful workstations and the eventual elimination of mainframes. It should be noted that the plan includes all computing activities, including administrative and business support, in the move to distributed resources.

The University has made a major commitment to a wide variety of *computing and information standards* with this plan. The intent of this commitment is to mainstream our activities and create much greater vendor independence by avoiding proprietary solutions and adopting open standards wherever possible. The plan calls for the establishment of standards for operating systems, data management, software portability, graphical user interfaces, hardware, interfaces, and network protocols. Compatibility and supportability are critical characteristics of the new standards-based environment. When the plan was released we supported 9 operating systems on campus. How much simpler the support task would be if we only had two or three.

The plan calls for the adoption of a *single relational database product* for use across campus. The use of large-scale relational database technology was limited on campus. We felt that relational technology could yield certain benefits for us. However, we wanted to restrict the use of relational technology to one product set. This was important for several reasons: we wanted to ensure that University data were accessible in a common way; we wanted to limit our support and training efforts to one product; we wanted to develop portable applications and databases; and we thought we could negotiate a more cost-effective deal with one vendor than we could with many vendors.

Services and Support

To ensure we were able to maximize the utility of the new environment, the plan called for the development of appropriate *training and support structures*. We would develop new classroom training for students, faculty and staff, on all campus standards, and expected hardware platforms. We would reassign staff to provide broader and deeper support for local and campus-wide networking. We would extend consulting support to the local computing environment. The plan also introduced the idea to create graduate assistantships specifically to provide departmental computing support and to provide research activities with extended professional services on a cost-recovery basis.

If we were successful in focusing on a set of campus standards, we would offer to *manage IT resources that met campus standards*. By limiting what we would support, we expected to be able to expand the population served and the level of support provided, even to taking over the management tasks for other departments, if appropriate.

While we had already implemented a fairly broad range of information services on campus, the plan wanted to *satisfy the increasing demand for information services* of different kinds. These included voice mail and fax services, as well as moving much of our existing information services--electronic mail, bulletin boards, conferencing, online library catalog, current contents databases--into the distributed environment.

Applications

We will continue to negotiate *site-license agreements for widely used software products*. Most of the software in this category has been for microcomputers, but we are increasingly adding workstation software. The wide range of functions includes wordprocessing, spreadsheet, symbolic math, statistics, and authoring languages. The plan itself does not specify software products by name, but the selections are clearly supported by the variety of training programs available.

The need for several *new administrative applications* is noted. The plan includes the general notion that applications should be consistent with the provisions of the plan, and the specific idea that administrative applications were not an exception.

The plan supports a common *end-user query and reporting* facility. Our customers had a great need to easily construct requests and retrieve information, and they needed much more control over local printing.

Plan Administration and Finance

Programs within the plan specifically describe the importance for management to commit to the plan. These programs also describe how the plan is to be *reviewed and updated* on an ongoing basis. Each year we produce a progress report and recommend revisions to be made to the plan. The Computing and Communications Services advisory groups are requested to review and evaluate the plan annually, but can make recommendations at any time.

The plan needs to be integrated with other plans. To achieve maximum effectiveness the plan cannot be considered to apply only to Computing and Communication Services--it must be accepted as the foundation plan upon which others would build. Likewise, this plan cannot be considered to be the only plan needed for computing and communications. The colleges and research centers should create their own plans describing how they will use the infrastructure utility created to support their activities.

There are a number of *financial implications* discussed in the plan. For the most part, the number of staff will be static. The plan noted in which areas additional staff support was likely to be needed. The plan also noted that most of those staff positions would be reallocated from other areas within Computing and Communications Services. Reallocation is a key word in this section of the plan. While the plan called for new funding to support its aggressive programs, it provides over half of those funds through the reallocation of existing Computing and Communication Services monies.

Implementing the Plan:

Our campus-wide high-speed network has been expanded considerably over the last two years. We have completed the connection of all academic buildings to our Pronet 10Mb/sec TCP/IP network. We have started to replace segments of the network with FDDI segments.

Our LAN environment is, for the most part, twisted-pair ethernet to the desktop with Novell's Netware® connecting workstations and PCs. The end-user "workstation" in academic areas is generally a PC with Microsoft's Windows® or DOS®, or a RISC workstation with Unix and X-Windows. In most administrative areas, it is a PC with Windows or DOS.

We have made good progress in moving away from mainframes to a distributed computing environment. In mid-1990 we had 4 mainframes with 5 proprietary operating systems. By January 1993, we will have one mainframe using 2 proprietary operating systems. That remaining mainframe supports a number of administrative applications, but the administrative computing environment is now a mixed environment--one mainframe and multiple RISC workstations.

We have installed almost 200 workstations since the plan was accepted. We replaced several PC public sites with RISC workstation sites, installed several new departmental workstation labs, and placed a number of additional workstations on faculty desks. We now sell and maintain IBM RISC workstations through our Microcomputer Store. By focusing on IBM RISC workstations, we were able to negotiate special pricing with IBM, yielding even greater cost-effectiveness.

Lehigh selected the relational products of the Oracle Corporation as our campus standard. Since we had a large variety of computing platforms when this all began, Oracle's wide portability was expected to be important. We are now focusing on the Unix environment. Oracle's RDBMS is available on a wide range of Unix-based platforms, with good connectivity, and has a large toolset for both application development and end-user data access. By focusing on one vendor's products, again, we were able to negotiate very favorable pricing for the products.

In support of administrative systems users, a "standard" application and services implementation model has emerged. The major components of the model include: (1) an application server accessed through the high-speed network; and (2) a LAN in the user office, attached to the network and consisting of a RISC station as the LAN server with a mix of simple DOS and Windows nodes as clients. Under this model, the actual databases and RDBMS engine reside on the application servers along with the major application processes and services that need to be available to a broad set of end-users. Each application server is administered centrally, including such tasks as operating system maintenance, application maintenance, database and tools administration, and backup/recovery processes. The LAN server provides typical work group benefits such as disk storage, file sharing, printer services and access to common DOS and Windows applications. Further, the LAN server can provide specialized application components or services that require the processing and graphical capabilities of larger PCs working in conjunction with the application server, in a true client-server relationship. By locating these special application components on the LAN, we are able to maintain a standard central copy of the components. The administration of the LAN server is a joint effort between the end-users and the computing staff.

We have engaged several pilot projects to test our ability to provide remote management of customer LANs with existing staff. We expect to be able to manage a few sites at most. Several departmental sites have been turned over to computing and communications services to manage. These sites have been ones which match the target environment in the plan.

There has been limited advisory committee review and limited integration with other plans. We have been able to fund the projects so far, but our budgets are expected to decline (in actual dollars) over the next several years. While we expected to have to finance much of the plan through reallocation, we did not expect that those budgets would be reduced. We have been able to develop some new funding from operator services (zero-plus) commissions and voice mail revenues.

Critique of the Plan:

The plan has provided an extremely important management tool for Computing and Communication Services. Not only does the plan define a basic direction and design for computing, but it continually aids the decision-making process by providing us with criteria to measure each proposal or possible action against. Appropriate actions appear clear when the primary decision criteria is plan-compliance, and the inappropriateness of other actions are quickly revealed in their non-compliance. Additionally, it is important to note that others on campus more readily accept our decisions because they conform to the plan. Senior management has not questioned major initiatives or policies when it has been demonstrated that they are in support and compliance with the plan.

Our vendors like the fact that we have a plan. They can focus their energies and can develop longer-term strategies for meeting our needs. We have been able to develop a number of partnerships which have been instrumental in our continued implementation of the plan. We have worked with IBM on examining the workstation environment for large-scale University application systems. We have worked with Systems and Computer Technology, Inc. (SCT) to develop improved applications for the distributed market. Finally, we are currently working with a partner to develop a suite of telemanagement applications for this new environment. We have been able to take advantage of special pricing because we were able to focus on workstation and relational technology. With such a clear understanding about where we are going, we can make commitments and decisions with vendors that support those directions.

A clearly articulated plan has produced two somewhat contradictory situations. First, the plan has created substantial expectations among our customers. The campus is eager for enhanced computer and information resources, wider and easier access, as well as new tools to increase productivity. Within administrative offices, most are willing and even anxious, to move into the new environment--wanting a combination of their current application system's functionality and the benefits of the new environment: SQL-based RDBMS, and improved end-user query and reporting tools. But, while the end-users generally view the plan as attractive and worthy of pursuit by the University, it has caused considerable confusion and concern when they seek to apply its direction to their specific offices. There is a belief that the plan will force them to move to new applications before the available products are mature. While we have reassured them that we will not force their movement to replacement applications that do not meet their needs, we have confirmed our intent to follow the plan. When an administrative application requires substantial improvement, we will seek and propose products that conform to the plan.

The plan narrows a vast number of computing and information models to a smaller set. But this has not limited the real options available to us. We have found a strong set of satisfactory computing resources, hardware, software development tools, and applications, that comply with the plan. And, in the cases where the applications have not been fully satisfactory, we have found vendors willing, through partnership, to create highly functional applications for the new environment. So the plan, by making Lehigh an attractive partner, may have actually increased our computing options rather than having limited them.

The plan does not deal fully with the difficulties of transforming our computing environment from the old to the new. This is especially true for administrative computing. The plan does not address the issue of how the migration of the administrative application stock can be accomplished. The plan simply notes that replacement applications that conform to the plan are currently available, or will be within the next several years. There is no plan, or funding, to acquire and implement these systems.

During the interim conversion period, several transitional problems have emerged. First, as we move to our new standards, the required support effort has actually grown. We still have multiple operating systems, file systems and development environments. For the Administrative Systems group, the basic toolset has doubled. Unfortunately, if an application fails, there are now fewer people who are familiar with the required tool, and even fewer who have a substantial level of experience or proficiency with it. Second, the level of application systems integration has actually declined. This is an unpleasant consequence of having applications reside in two very different environments. Formerly integrated systems have been separated in order to facilitate our movement to the new environment, causing us to create new interfaces. We expect that as the new environment becomes our standard, these problems will ease.

Although the plan did not deal fully with the difficulties of the transition, the new computing model has proven to be effective and flexible. Beyond our primary administrative implementations of an Admission system and an Alumni/Development system, we have used the new application development environment to quickly construct several reporting and analysis databases. These databases have included medical claims information and summarized financial data. We expect that additional data, currently maintained in the old environment, will be transferred to the new environment to permit the end users to access it with the new tools. We hope that this step will facilitate the full conversion of the applications in the future.

One of the objectives of the plan was to create a more standard computing environment, which is easier to support. Prior to the plan, we had a few large computing resources with different operating systems and data structures. Now we have fewer operating systems and data management structures, but the productivity gains here have been more than offset by the added complexity of the new environment. This added complexity has at its root the sheer number of computing resources that must be supported. Each new compute, file, or applications server adds, proportionally, to the support work load. Each requires hardware, operating system, RDBMS, and tools installation and maintenance support. To control this support effort, we are seeking to regularize our support processes and to partition the services and tools on each resource. With the significant increase in computing resource complexity, there has been a parallel occurrence in the software development area. We noted earlier that there is an abundance of tools in the new environment, which adds to its general complexity. A point of concern with our plan is that on the issue of identifying the "right" long-term toolset, the plan remains at a very high level, offering little help. There is no mention of an appropriate application development methodology, no mention of CASE or Object Oriented development tools. The silence of the plan in this area adds to our implementation complexity, but it also adds to the *flexibility of the plan by allowing* those who are closest to the implementation to make the final choice of tools.

Although the plan does not specify any changes within the Computing and Communication Services organization necessary to accomplish the plan objectives, it has been a consequence of our implementation. Each department has accepted new responsibilities as a necessary step toward our accomplishment of the plan. As an example, the Administrative Systems group has dramatically broadened its duties. Prior to the acceptance of the plan, this group's primary responsibility was to create and maintain application software on a mainframe, LANs and PCs. Now the group's primary responsibilities have expanded to include workstation and LAN operating system installation and maintenance, RDBMS and related products installation / maintenance / administration, and database administration activities for those applications that are currently functioning within the new environment. Twenty percent of the Administrative Systems group's effort is now spent supporting the new environment's infrastructure. The reallocation of effort to the infrastructure support function has lessened the overall ability of the office to create, deliver and maintain application systems and services, although the quality of the delivered systems and services is higher.

Finally, the plan acknowledged that Lehigh's funding for Computing and Communication Services, as a percentage of the general budget, had been declining for several years. The plan proposed a funding scheme which depended on significant budget reallocation within the Computing and Communication Services organization plus an injection of new funds, both one-time and continuing. To date, internal reallocations, via the elimination of several mainframes, have provided the bulk of our implementation funding. In addition, there has been some new funding, predominantly one-time monies, available for classroom and lab upgrades to workstations and administrative system upgrades. Overall, the total budget of the Computing and Communications Services organization has declined, in real dollars as well as a percentage of the University's budget, during our implementation period.

Computing Services Planning, Downsizing, and Re-organization at the University of Alberta

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Abstract

In a six month period, Computing and Network Services formulated a strategic plan and at the same time downsized and re-organized to meet financial constraints and to react to changing technology, especially distributed computing. Since then, the department has picked up momentum to implement some large campus-wide projects.

The circumstances that led to the metamorphosis of our organization seem to be common to many institutions. We describe the process used to accomplish the changes and how it provided a smooth transition to a new department that is able to react to new technology trends and user requirements.

Computing at the University of Alberta

Substantial changes in the computing organization and facilities at the University of Alberta during the past months have their origin in the evolution of computing and the local economy over the past two decades. In the seventies and early eighties, the University of Alberta benefitted from state-of-the-art computing facilities that attracted many researchers and students to Edmonton. This was a time of economic boom for the oil industry in Alberta that saw many beneficiaries, including the universities in the province. The capital and operating funds for computing at the University were generous, with capital funds peaking at $8 million a year in 1982 (see Figure 1). The computing services organization had 170 employees. People still remember the excellent mainframe services provided at that time. Computing equipment, both hardware and software, was regularly purchased soon after new products were available on the market, giving researchers and administrators the necessary tools to be competitive with the top universities in North America.

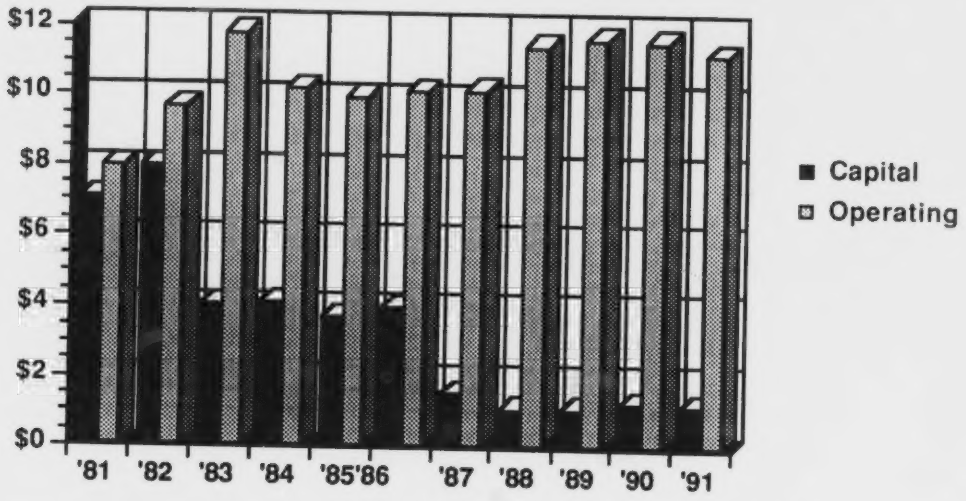

Figure 1: Retrospective of CNS Capital and Operating Funds (millions of dollars).

Unfortunately, these good times changed abruptly in the eighties. The economy went into recession. Computing funds quickly shrank, reducing capital outlays by a factor of eight. At the same time, workstations became affordable and started spreading rapidly on campus. The computing services organization found itself crippled by reduced funding; mainframes and tools became old; a stifling atmosphere set in. Lack of funds became the reason for not reacting to the technology revolution in workstations and distributed computing. This left new owners of workstation equipment without support and guidance to ensure connectivity and interoperability. In summary, the computing scenario at the University of Alberta in the late eighties and early nineties was made up of a computing services organization with reduced funds, as large a staff as ever, aging mainframes, no distributed computing support, clients longing for change, and no planning in place.

The University decided to try to improve campus computing support toward the end of 1990, even though the level of funding that had been available in the past was not to be obtained again. This led to a series of events. In late 1990, the new Vice President of Student and Academic Services, Dr. Lois Stanford, started collecting computing requirements from users under the auspices of the University Computing Advisory Group (UCAG). This led to UCAG task force reports in May 1991 for networking, instructional, research, and administrative computing.

An important document, *Maintaining Excellence and Accessibility in an Environment of Budgetary Restraint*, was issued in February 1991 by University President Paul Davenport. Financial changes required for the University were described in this report. The computing department was asked to transfer salary funds to capital funds, at a rate of $200,000 a year for five years, which would result in the department having an additional $1 million a year for capital allocations.

A new director for the computing services department, at the time called University Computing Systems, was hired at this stage. I started working in April 1991 with the mandate to carry out all necessary changes to improve computing support on campus. It was clear that in the current environment, where information technology is evolving rapidly, and where financial constraints require focusing of resources, that good planning was and will continue to be mandatory.

Planning Expectations

Strategic planning has to address the expectations of users, senior University administration, and computing and network services staff. Many expectations had been described in the documents mentioned above, but it did not take long to notice that other equally important expectations had not been documented anywhere. For example, the staff of the computing department felt that communication with senior University administration had been poor for many years. Whether this was justified or not was irrelevant; what counted for planning purposes was the perception. To be able to carry out a plan, mutual respect between the department and other parties had to be established.

The biggest challenge before initiating the strategic planning process was to understand all expectations, synthesize the requests, and ensure that the planning process addressed them all. The major expectations could finally be divided into four categories. The following is a summary of these expectations coming from users, senior University administration, and staff.

Technology Issues

From a technology point of view, the campus wanted support for distributed computing. This meant high-bandwidth networks, services to help clients with the management of their own computing equipment, and the establishment of guidelines for purchasing equipment to ensure adequate support and interoperability. Requests were also made to increase computing capacity for both researchers and administrators, to integrate and modernize administrative applications, and to provide enhanced support for instructional computing (instructional labs and computer-assisted instruction tools).

Communication with Clients

Communication between the department and clients had to be improved. There was a clear demand to provide technical assistance through a single point of contact between the department and the users. As well, communication between the department and senior University administration had to be improved.

Departmental Organization

The message from the University President was clear on the need for departmental downsizing. The expectation was also voiced that the department re-organize to better amalgamate the two main groups supporting academic and administrative computing that had not been adequately merged in 1988, resulting in inefficiency and duplication of work (Figure 2). As well, it was felt that the department's organizational structure had too many layers of management—improved communication and efficiency required a flatter organization.

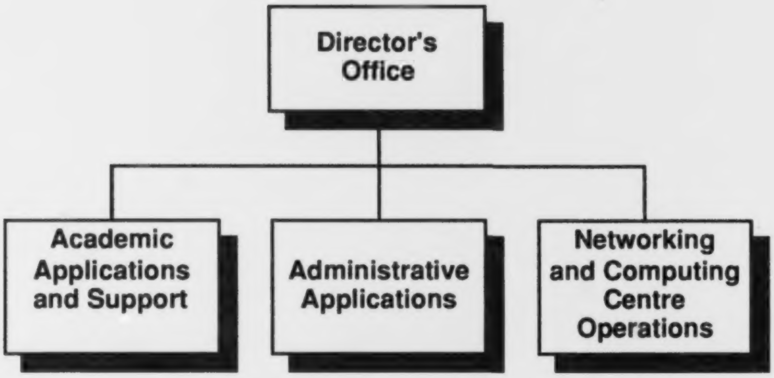
Director's Office
Academic Applications and Support
Administrative Applications
Networking and Computing Centre Operations

Figure 2: The primary divisions in the old computing services structure (1991).

Another expectation was that the department change the character of its support. As opposed to being belated followers of technology trends, clients and administration wanted the department to be a participatory leader, guiding the campus in formulating technology directions and in the use of information technology. There was also the request to turn the department from a provider of implementations (e.g., programming assistance for researchers) to a provider of infrastructures, such as servers to distribute application products, networks, standards of data storage and retrieval, and so on.

Funding

It was expected that we would follow the presidential recommendation of transferring salary funds into capital and that we would implement all technological and other changes without asking for financial support beyond the usual annual capital and operating allocations. The message was clear that we had to be creative in financing the computing operation, as more funds could not be anticipated.

Planning Constraints

Before starting the strategic planning process, it was also important to understand the constraints under which planning had to be carried out. Financial constraints related to departmental downsizing were severe—the first $200,000 to be transferred from salary to capital had to be complete by April 1991 (the very month I took on the job of director). Fortunately, we agreed with the President to defer the transfer of $400,000 to April 1992, but even so lay-offs had to be identified soon as we had to find money for severance pay.

Another difficulty in downsizing was the fact that most of the staff are unionized. Within the five job categories we have, only the most junior people, those hired last, could be laid off. This was a problem as the department was already aging. The union agreements also made vertical cuts difficult to implement; the department does not have many generalists, so expensive cross-training would have to be organized for major job re-assignments to occur. Finally, the fact that the department had lost credibility imposed another constraint: we had to show quick results and relevance to clients.

Planning Strategies

When trying to define the strategic planning process during the spring of 1991, I worked with three inherited associate directors. We had to decide which problem to attack first. The common wisdom is that organizational structure follows strategy: one builds an organization to carry out a strategic plan. Unfortunately, though, because of the time constraints imposed, we could not afford to formulate a strategic plan first and then worry about organizational structure and lay-offs. Time was also of the essence in that departmental morale had been low for a long time. Staff were well aware that they were not providing the level of computing support of the past. When the news spread that staff had to be laid off, morale deteriorated even further. We therefore decided on the following planning strategies, which called for concurrent and staged approaches to planning and reorganizing.

Cutting Quickly to Provide Stability

As a top priority, we decided to settle the downsizing issue, trying to overshoot the presidential recommendation for the coming year so as to provide stability for as long a period as possible. Even though we had to rush at this, careful thought had to be applied to ensure minimal negative impact to the department and to ensure that the people involved were treated as humanely as possible. While downsizing, we had to avoid laying off junior staff which would result in a top-heavy organization.

Managing the Department

Strategic planning processes are usually formulated with the management team to ensure that managers, charged with carrying out the plan, feel ownership in relation to it. Since we had to re-organize and flatten the organization, it became clear that more managers besides the three associate directors needed to report to the director and thus be involved in the planning process. To start the planning process, a new management team had to appointed, even before re-organization.

Buying into the Plan

As communication had been poor between the department and other campus constituencies (and also inside the department), it was essential that the planning process involve senior administration, critical clients, and as many staff members as possible.

Aerating a Stifling Atmosphere

During the past few years, both management and staff had been waiting for somebody to come in and fix all the problems. It had to be made clear that one person alone could not carry out the entire job and that pro-active involvement from every staff member in the planning process was expected. A positive, can-do attitude had to be developed.

Maximizing Winners/Minimizing Losers

We set the goal of asking ourselves throughout the planning and re-organization period who the losers and winners would be as a result of changes in the department. We aimed at maximizing the number of winners.

Limiting the Period of Pain

No matter how well change is managed, it is connected with uncertainties and pain, which are often carried home to families after work. We wanted to confine the pain to a six month period.

Building Confidence with Early Results

To regain credibility for the computing services department, we knew we had to plan in such a way as to achieve early and visible results. Communication with our constituencies about all our steps was essential.

Planning Process

Strategic plans are usually carried out from the top down: the management team agrees on high-level goals and strategies, and from these the staff later develop tactical and operational plans. This type of planning process, however, is too long to achieve early results and may, because of its initial managerial focus, prevent staff from providing input to the direction of the department. We therefore decided on a simultaneous bottom-up/top-down approach to the planning process. There were some risks associated with this—at the end of the process, for example, the plan had to be a consistent and integral whole—but we decided the risk was worth taking.

Staff Input

The bottom-up planning process was carried out as follows. In May 1991, an on-line discussion forum was opened for the staff. This provided a way for staff to exchange information and ideas and to comment on actions taken by management (which were made public throughout the planning period using weekly electronic staff newsletters). During the same period, six planning task forces were formed within the department, defined and mandated by the three associate directors and myself.

The internal task forces represented an embryonic formulation of new organizational groups to be used later in the new departmental structure. Each task force had a leader. Three of the task forces were led by the associate directors, while the rest were led by temporary appointments. The task forces were composed of staff from different groups of the old organization—the first attempt to improve staff interaction by mixing people who had never worked together before.

The result of the task force work was a planning document which we called the "working papers" which contained what the staff thought ought to be done to improve computing support on campus.

During the internal task force process, the University Computing Advisory Group (UCAG) was kept informed of events. We gave its members opportunity to comment on the working papers in September 1991. UCAG had in the past been presented with a series of faits accomplis. This was the first time that they were made part of the decision-making process.

Management, University Administration, and User Input

The top-down planning processes started at the end of September 1991. I had appointed the new management team in July. It was with this team that the strategic planning process was to be carried out.

Planning activities crystallized in an intense set of week-long sessions which included senior University administrators, UCAG Task Force chairs, and departmental management. The sessions were moderated by a professional facilitator with many years experience in strategic planning and the information technology industry.

Phase I of the facilitated planning involved the University President, Vice-Presidents, and myself. Agreement on the mission of the department was the result. Phase II of the process, involving some UCAG members, the Vice-President of Student and Academic Services, and the department's management team, developed high-level goals and pinpointed areas of information technology of strategic importance to the University. With these strategic areas in mind, in Phase III the management team decided on the future direction of the department by weighing various options against the available resources. Phases IV and V, also involving the management team, developed a consensus on an action plan to give the strategic options a concrete basis in the activities of the department.

Planning Synthesis

A the end of the bottom-up/top-down planning process, we had material in hand for two plans: a strategic business plan for users and the public at large, and a tactical plan based on the working papers which defined specific tasks to be carried out. We had to make sure that the two plans matched, and some adjustments had to be made. For example, during the strategic planning process, users asked us to become involved in computer-assisted instruction. This area had not been taken into account in the working papers. All adjustments, however, turned out to be straightforward, and in December 1991 UCAG approved our strategic plan. The plan, *Networking Computers and People on Campus and Beyond*, was published early in 1992 and we are regularly presenting it through talks to various interest groups on campus.

It was clear to us that *Networking Computers and People on Campus and Beyond* could only be executable and gain credibility if we also had a financial plan to carry it out. A list of expenditures necessary to implement the strategic plan, above recurrent expenditures, was prepared by each manager. Careful administration by the management team had allowed us to save a good deal of money, for example by renegotiating contracts with vendors and consolidating mainframe usage. This, together with the salary-to-capital transfer and the hope that the usual annual capital and operating allocations would not change over the next years, gave us a pleasant surprise. Funds are few, but with careful staging of projects over a four year period, they presently look sufficient to carry out the most important tasks outlined in the strategic plan.

Planning Outcomes

Technology

The strategic plan focused our attention on implementing the strategies defined therein. The largest projects we have started implementing are:

Fibre Optic Backbone Network

The planning process made it crystal clear that the biggest expectation among users was progress in developing a modern data communications network on campus. A new high-capacity and high-speed backbone network is essential for the University. It will help address the growing cooperative computing requirements of administrators, instructors, and students. It will allow more desktop systems, LANs, and client/server facilities to be added to the network, and will support the use of networks for sharing complex multimedia files and very large data sets in research, education, and administration.

We have started work on the initial phase of a 100 megabits per second FDDI fibre optic backbone network for the campus. The main backbone length will be six kilometres. A detailed backbone plan has been prepared that describes a staged implementation over three years, including expectations and limitations of the network and the backbone topology. The first phase of the project is to be completed in December 1992, and will connect the Computing Centre with the Central Academic Building. This route will provide a good test bed for FDDI technology on the campus, as it will connect a variety of Ethernet and Token Ring LANs and several microcomputer laboratories.

Integration and Modernization of Administrative Applications

We have started a phased project to mount a new technology platform for administrative applications, one that ensures easy data access and manipulation by departments. The first phase involved understanding the current baseline; professionally facilitated sessions with administrative units and faculty gave rise to road maps showing the interrelationships among institutional data that is currently kept on campus. Subsequent phases will define a new technology direction, see the acquisition of a new technology platform, and result in formulation of a campus information systems plan.

Distributed Services

A new type of service is being launched, aimed at supporting users and their equipment at their locations. Service representatives from our organization, dedicated to meeting the needs of specific departments, will be our primary means of contact at the faculty level.

Organization

After we felt comfortable with our strategic plan, we looked seriously at the internal planning task forces as the basis for departmental re-organization. After a few adjustments and lengthy discussions on how to divide software support between the groups, we published a new organizational structure, and, with staff input, redistributed people among the new organizational groups. We declared ourselves officially re-organized as CNS—Computing and Network Services—in January 1992 (see Figure 3). The re-organization process was straightforward and smooth. An indication of improved morale was the immediate transliteration of CNS as "central nervous system."

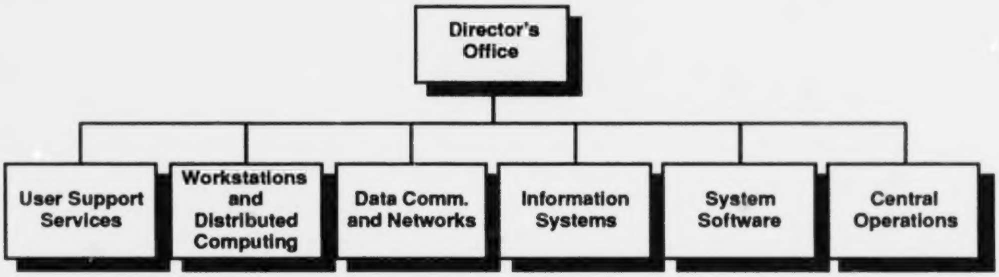

Figure 3: The main groups in the new CNS organization.

The working papers are being used by each new group as tactical plans to carry out *Networking Computers and People on Campus and Beyond*. The new organization is flatter, with only one level of management and one level of supervisors. The mandate of each group follows technology lines (see Appendix A for the mandates of the new groups).

Communication with Clients

We have a much stronger focus on our clients now. We are creating advisory committees in such areas as networking, research computing, numerically-intensive computing, and technology standards. Some of the committees have already proven very useful. The network committee, for example, was a very good sounding board while preparing the FDDI backbone plan.

Another important initiative is the establishment and facilitation of user groups by the department. Relevant information from the user groups will be brought back to the management team and will be used to improve services.

A new Help Desk and User Support Centre are providing a consistent interface between clients and Computing and Network Services; they will also provide insights on user requirements. Distributed services will give us a better understanding of information technology requirements at the faculty and departmental levels.

Funding

With the shrinking of staff and the transfer of salary funds to capital, we will see a decreasing operating budget and an increasing capital budget. Once central mainframe support and associated revenues decrease further, the operating budget will decrease even more than shown in Figure 4. This is a big concern that we will have to resolve in the near future.

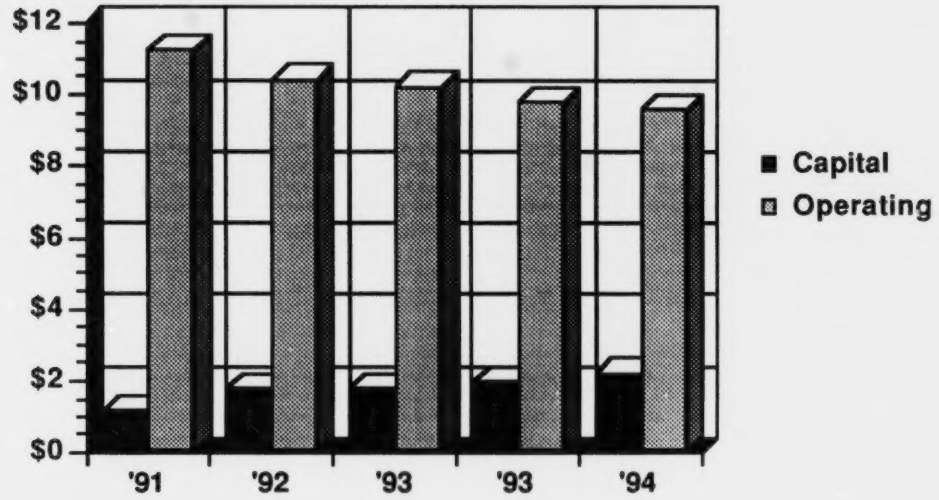

Figure 4: Projected CNS Capital and Operating Funds (millions of dollars).

A Critical View

There are two main parts to a plan: a business plan and a technology plan. Our strategic plan addresses our business functions. It allowed us to get started on some major projects, but it is now time to develop a technology plan to guide us, for example, in identifying a new technology platform for information systems, and in deciding which information technology standards to recommend to the campus. We have just identified a new position, Manager of Technology Directions, to facilitate and coordinate the process of formulating a technology plan. Other computing services departments which have recently undergone a planning process, such as Indiana University, have started with a technology plan. We decided to focus on early results, and have therefore chosen to formulate a technology plan after completing a strategic (business) plan.

We are comfortable with the new organizational structure we have created for Computing and Network Services. It has to be noted, however, that due to the intricacy of today's information technology, many projects extend across group lines. Mounting a new technology platform for information systems, for instance, will involve almost all groups. For this reason, we are establishing task forces and project leaders that will deal with complex projects. Monthly project review meetings are aimed at coordinating our efforts.

So far, we have only started to train our staff in a few areas for the new emphasis on client-centered services. We must take a more aggressive approach in training staff to deal with distributed computing and in training generalists who can provide end-to-end service.

Once we had formulated our directions and made clear to staff that we were seeking their active participation, the department gained new momentum. Empowering the staff and pushing down responsibility through the organization is very healthy and is bearing fruitful results.

The challenge we had in planning, re-organizing and downsizing was to break up an intricate problem into smaller pieces. Even though we succeeded in doing this in many cases, sometimes we felt, and particularly the author, that there was an insurmountable wall to climb. We often realized that the wall was put up by processes that discourage the achievement of results. Focusing on managing results, instead of managing processes, has been very useful. It was also very useful to compare what we were doing with changes at computing departments at other universities. We have learned a great deal from plans and articles that were kindly sent to us by colleagues. We hope that this paper will likewise help other organizations in their planning and re-organization efforts.

Appendix A -- Organization of Computing and Network Services

Director's Office

Director - Dr. Monica Beltrametti

The Director's Office collects knowledge on information technology and disseminates it to the campus. It coordinates planning for the application of new and future technology and proposes financial plans and budgets for the computing and data communications needs of the University. The office manages joint ventures and collaborations with vendors and other institutions to exploit the application of information technology within the University; it determines CNS services and institutes programs to guarantee their quality, and supervises CNS groups and projects. The office also coordinates the exploitation of University information technology resources and coordinates interaction with the University community to understand information technology needs, responding as appropriate to client requests.

User Support Services

Manager - Ruth Simpson

The User Support Services group acts as an interface between clients and CNS. Through the CNS Help Desk, the group provides problem resolution by using expertise within CNS and on campus. The group is the central repository and dispensary of information about CNS services and information technology knowledge available on campus. It acts as a front-line filter to gain an understanding of technical problems, requirements and concerns of clients. It also organizes courses and seminars, and promotes CNS services.

Data Communications and Networks

Manager - Keith Switzer

This group plans, installs, and operates the campus network, connections to external networks and basic data communications applications. It decides on data communications protocols, manages network traffic, determines fault locations, and coordinates repairs. Guiding clients in planning local area networks, the group collaborates with other CNS units in offering complete solutions to users. As requested, the group operates and maintains local area networks on a cost-recovery basis. The group also participates in various provincial and national networking bodies and provides an outlook on the future evolution of data communications and networking.

Information Systems

Manager - Wally Affolder

The Information Systems group facilitates the planning, development, and support of computerized applications to meet the diverse information systems requirements of all segments of the University community. It establishes and manages the process for prioritizing projects to be developed within an information systems plan, determines the framework for the development and operation of fully integrated information systems, and provides an infrastructure for clients to develop their applications within this integrated environment. On a contract basis, the group provides a comprehensive set of services to address the development and ongoing support of information systems. The group also advises on the purchase and development of information systems to meet clients needs and provides an outlook on the future evolution of information systems.

Workstations and Distributed Computing

Manager - Grant Crawford

This group helps clients in planning the integration of cooperative computing solutions to support their research, instructional, learning, computer laboratory, and administrative needs. It advises clients on standard and complete solutions, taking into consideration economies of scale (on request, the group coordinates the installation and maintenance of these facilities on a cost-recovery basis). The group maintains knowledge of the marketplace to identify emerging products as contenders for support and runs a demonstration centre for this purpose. It offers services to encourage and support ethical use of computing resources. On demand, the group manages the purchase of, and contracts for, application site licences and volume purchase agreements.

System Software

Manager - Ian Simpson

The System Software group drives the evolution of central facilities. It supports selected operating systems, related software products, and multi-platform/multi-user application packages, manages purchase and maintenance contracts for such software, plans its evolution, and strives for its optimal use. The group provides the software infrastructure to provide network services, such as backup facilities, e-mail and conferencing. It installs software at cost for other computing facilities and contracts as requested to develop software tools of general interest. The group also provides expert consulting and an outlook on future technologies and directions.

Central Operations

Manager - Jorge R. Beristain

This group manages central computing resources (including central printers, plotters, and mainframes) and does physical planning for their evolution. The group ensures proper physical access to these resources, and coordinates CNS efforts to ensure security of premises and disaster recovery. Central Operations collaborates with the System Software group to ensure appropriate system configurations and with the Data Communications and Networks group to ensure network availability. The group also assists with data input, operates optical mark reading services, provides data storage and system backup functions, and provides computer output delivery.

Development of an Effective Strategic Plan for Information Technology

Kathryn O. McCubbin
Christopher Newport University
Newport News, Virginia

Strategic planning often is viewed an exercise to demonstrate the existence of the planning function rather than a working document that guides the institution through the maze of expected and unexpected events toward prescribed goals. The strategic planning experience at Christopher Newport University has developed over a five year period as a consequence of internal and external needs. This paper describes the events which shaped the information technology strategic planning process at CNU and how effective the process has been in realizing the institution's goals.

Evolution of the planning process

In 1974 Cyrus Gibson and Richard Nolan published the article "Managing the Four Stages of Electronic Data Processing Growth"[1]. Since then this work has been expanded by Nolan and used as a frequent reference in describing the evolution of information technology. One of the reasons for its longevity in the literature is that it applies to technological growth in an organization for new technologies as well as old and appears to recreate itself in an organization as that organization changes over time. In this paper I apply Nolan's curve to the evolution of the Information Technology (IT) planning process likening his four stages of; initiation, expansion, formalization, and maturity, to the planning stages of:

1. Awareness of the need for planning;
2. Expansion of IT planning throughout the campus;
3. Formalization of the IT planning process in the governance of the institution; and,
4. Integration of the IT plan into the institutional strategic plan.

Over a five year period Christopher Newport University has experienced the first three stages of IT planning and is currently experiencing the fourth, integration.

1. Awareness of the Need for Planning

In 1985 many of the faculty of the Department of Physics and Computer Science working with the newly federal funded facility, the Continuous Electron Beam Accelerator Facility (CEBAF), identified a need to access the NSF international network from their campus office computers as they could from the CEBAF. To do this, the departmental local area SUN network had to be linked to the central academic computer which in turn would communicate with CEBAF over a 56 Kbps dedicated phone line. Once linked to CEBAF the faculty would have the same communication links from the campus as they had from CEBAF. To accomplish this, fiber cable had to be installed between the building housing the department and the building housing the central computer. Since central computing resources were controlled by the financial vice president this required crossing organizational boundaries which in turn required forming an inter-organizational project team which would develop design specifications, a budget, and a project schedule. The project team consisted of volunteers from necessary organizational units who met regularly and called themselves the Information Technology Advisory Group (ITAG). The group was self empowered and informal having received no official recognition from the administration. The connection of Christopher Newport University to NSFnet (now INTERnet) was accomplished within one year.

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[1] Cyrus F. Gibson and Richard L. Nolan, " Managing the Four Stages of EDP Growth," Harvard Business Review, January-February 1974, PP. 76-88.

Since the ITAG was non representative of the campus community it could not be used as a standing committee to advance campus wide technology goals. It was viewed generally as an elitist clique which discouraged participation by outsiders. On the other hand, the ITAG was small, unencumbered by most bureaucratic practices and could get things done in a relatively short period of time. It was effective group confined to serving a specific constituency.

Expansion of the IT planning Process

In 1990, two years after the connection of Christopher Newport University to INTERnet which established the first spoke of the star architecture of the campus backbone, the central computer services group which had formerly reported to the financial vice president began reporting to the academic vice president. The Information Systems Planning Committee (ISPC), a previously established but dormant planning group, was activated. The ISPC reported to the academic vice president and became part of formal university governance having senior members from both the academic and administrative parts of the institution. The director of the central computer systems chaired this group which consisted of the academic deans, the registrar, director of planning and budget, the library director, and the assistant to the president.

The ad hoc ITAG which had pioneered the IT planning effort became part of formal university governance having requisite members from all campus constituencies. The chairman of this group reported to the ISPC. The rationale for this structure was that ITAG would represent the "grass roots" information needs and concerns of the campus community and would be responsible for updating the IT strategic plan annually. The plan would then be presented to ISPC for review and eventual acceptance, forwarded with ISPC recommendations to the academic vice president who would review it, send it on to the President for signature and then to the state council on information management.

Formalization of the IT Planning Process

The initial plan which the ISPC developed was very loosely coupled to the annual budget. The state council on information management required that the plan have a four year horizon, hence, only major multi-year projects tended to be included. Potential funding sources were identified but the probability of realizing such funding was not, hence, there was no real match between the strategic plan and the budget for the central computer services function. In addition, the multi year projects obscured smaller but more urgent needs. In an attempt to correct this, the subsequent update of the strategic plan included a comprehensive list of university IT needs compiled from interviews with department heads and administrators. This was a step in the right direction but still did not tie university IT needs to the annual budget process. As a result, an expectation had been created on the campus that could not be satisfied because it was not reflected in the budget of the institution. To complicate matters, no additions could be made to the IT budget during the fiscal year because of state requirements.

In an attempt to address this deficiency for the coming update of the IT strategic plan, the ISPC has been directed by the provost to prepare a campus-wide IT budget that ties the budget of the central computer group to the IT strategic plan. This has the advantage of locating and identifying IT costs which heretofore were hidden in sub-organizational expenditures. Placing all the IT costs in one basket raises the visibility of the IT function and clearly demonstrates the interdependency of various institutional units on information systems. For example, the need for electronic access to data across organizational lines surfaces as common to all organizational units. The completion of a campus-wide network, preached formerly to a polite but unconvinced senior management, becomes understood as essential to the future of the institution.

Integration of the IT Planning Process into the Institutional Strategic Planning Process

Concurrent with the events that motivated the development of an IT strategic plan, events were occurring to promote the development of a institutional strategic plan. The State Council of Higher Education in Virginia and, independently, the Southern Association of Colleges and Universities required that Christopher Newport University develop a strategic planning process and a committee called the Strategic Planning and Evaluation Council (SPEC) was created. The chairman of the council is the assistant to the president and the deans, one member from each of the four colleges as well as one representative from each vice-presidential office make up the council.

The council is currently in its second year of activity. In FY92, the first year of it's existence, the council developed a strategic planning process using previously existing documents to define the institution's mission, values, and goals. The process was designed to proceed in lock step with the biennial budget cycle so that programs identified during the planning and evaluation stages of the process would fit into the budget process. For example, one of the goals of the institution is to provide an international program in the undergraduate curriculum. This objective was prepared initially as a budget initiative in the off year of the budget cycle and received funding in subsequent biennial budgets. The planning process provides for an annual forum for faculty, staff, and students in which the proposed strategic plan of the institution is discussed and an evaluation of the achievements of past objectives is encouraged. The results of this forum are used as feedback in the preparation of the update of the strategic plan.

Although the specifications of the planning process have been completed, implementation of the plan is proceeding cautiously. On retreat at the beginning of the second year of the council's existence, members presented white papers on academics, curriculum, faculty, students, and, support services. Following are some of the issues that directly impact the IT plan:

Academics:
What is the proper balance of undergraduate and graduate education?

Curriculum:
What general education objectives do we wish our graduates to achieve?

Faculty:
What should be the proper balance of scholarship, research and service?

Students:
How can we optimize the chances for academic success so that each admitted student has an equal opportunity to graduate?

Are sufficient steps being taken to ensure that the university will meet its legal and ethical responsibilities in providing accommodations to students with handicaps?

The council is currently working its way through these issues using a bottom up approach to developing a new mission statement and vision of the institution, the rationale being that as the council reaches consensus on the issues it will be defining who we are (mission) and where we are going (vision). One of the outcomes of these discussions is that information technology is becoming a key institutional strategy and the IT strategic plan is being considered as an integral component of the institution's strategic plan which may set a precedent for other administrative functions.

Influence of Internal and External Factors

Internal Factors

John M. Bryson in his book, Strategic Planning for Public and Non Profit Organizations, addresses one of the significant difference between the planning processes of business and those of public and non-profit institutions[2]. He describes this difference as the inductive versus the rationally deductive. In the world of business goals are defined at the top of the organization and propagate down the hierarchy in the form of programs, policies and eventually, actions. There is a unity and clarity of purpose in this traditional top down structure that arrives at consensus in a relatively straight forward manner. However, in the university environment the planning process reflects a bottom up approach wherein lack of consensus gives rise to conflict which in turn defines issues. Discussion of the issues results in programs which evolve into policy and form the basis of institutional goals. This has been the case at Christopher Newport University. The internal factors which influenced the IT planning process began with the grass roots need for telecommunications and developed into programs and policies that are now before the president's committee on planning. The timing of the major internal factors, not surprisingly, are consistent with the major changes in the Nolan curve.

External Factors

Without the motivation provided by external regulating agencies it is doubtful if the IT strategic plan would have progressed as far as it has. In 1987, the commonwealth of Virginia created an oversight group, the council on information management with two advisory subcommittees, one representing the central agencies and the other representing institutions of high education. During its existence, standards, policies, and guidelines have been distributed which included the state standard for IT strategic planning. Other prominent data issues such as access and security have also been addressed by the commonwealth and set the stage for serious discussion by individual institutions which promotes active local IT planning.

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[2] John M. Bryson, Strategic Planning for Public and Non Profit Organizations (San Francisco: Jossey-Bass, 1988) chapter 8.

State assessment and regional accreditation bodies have required that Christopher Newport University develop a strategic planning and evaluation process and that it be implemented by 1994. This has received the attention of senior administrators and major effort is underway to comply with the requirements. It has resulted in introspection and needed communication among various factions of the campus. The institution has become acutely aware of the need to consider the perception of the community it serves as well as major technological trends by regulatory bodies and competitive institutions. Knowledge of the external environment and the market has become a significant factor in the planning effort.[3] The timing of the major external factors are also consistent with the Nolan curve.

Conclusion

Information and how it is accessed is essential to the viability of institution of higher education. The dynamics of this technology require that a planning process be developed and nurtured. Decreasing funds, increasing student bodies, and competition propel information technology planning into a primary role in the overall strategic plan of the institution. Planning on both the IT level and the general level must be representative and evolve from the constituencies of the institution. Coherence of the planning effort relies on strong internal and external motivation.

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[3] George Keller, Academic Strategy: The Management Revolution in American Higher Education, (Baltimore: The Johns Hopkins University Press, 1983), chapter 7.

CAUSE
92

TRACK II

MANAGING AND WORKING WITH SHRINKING RESOURCES

Coordinator: Barbara B. Wolfe

Shrinking resources create expectations for more productivity from technology. Dealing with increasing costs of personnel, software, hardware, and technologies often makes managing computing and information services departments a very painful process. Papers in this track offer some strategic solutions to such problems.

Effective Planning and Management: Methods and Tools for Times of Declining Resources

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Abstract

The common trends of declining funding and increased demand for services and accountability experienced by institutions of higher education over the last few years are predicted to continue throughout the 90's. The resulting need to do more with less and do it better than ever before demands management and planning tools which are both effective and low-cost. Without the use of daily management tools that translate organizational objectives to the work group and staff level, planning efforts are doomed to failure. This paper presents a set of tools and methods which, taken together, can and have proven useful in achieving these ends. The primary focus of the paper is a case study of a suite of processes and tools that Indiana University's computing services organization uses to cost-effectively implement its strategic vision on a day-to-day basis. Each tool is described from a "how to" perspective.

MANAGEMENT REQUIREMENTS IN TIMES OF DECLINING RESOURCES

After decades of incremental increases, higher education administrators have suddenly been forced to grapple with reduction, reallocation, and retrenchment. They now must pay closer attention to cost effectiveness, careful use of resources, and accountability. Departments, divisions, and work groups must do more with less, and do it better than ever before. Managers at all levels, especially in information technology, need more effective planning processes and management tools to help the organization channel scarce resources toward high-priority objectives while maintaining high-quality service. These processes and tools must enhance productivity while remaining cost-effective. Effective planning processes and management tools can change organizations for the better. They provide heightened accountability, improved organizational responsiveness, and better quality services and support. But implementing these processes and tools is both a science and an art, requiring careful timing and attention to detail, such as developing effective work plans and allocating limited resources. Implementation requires adeptness in human resource issues, employee participation, communication, and commitment. And it requires that managers be proficient in weaving these processes and tools into their daily responsibilities, skillfully guiding staff toward the organization's shared vision.

This paper presents a set of tools and methods which, taken together, can and have proven useful in achieving organizational efficiency and effectiveness. It provides a case study of a set of processes and tools that Indiana University Computing Services uses to cost-effectively implement its strategic vision on a day-to-day basis.

UNIVERSITY COMPUTING SERVICES

Indiana University (IU), founded in 1820, is one of the oldest state universities in the Midwest. With an enrollment of over 96,000 students on its eight campuses, IU ranks as one of the largest institutions of higher education in the United States.

Indiana University's computing services were traditionally handled by two distinct and separate organizations: Bloomington Academic Computing Services on the academic side, and Information Services on the administrative side. In 1989 a single computing organization, University Computing Services (UCS), was created by merging the two organizations and their different management philosophies, technology bases, and cultures. UCS was designed to more cost-effectively provide computing services to academic and administrative users. It took on campus and system-wide responsibilities; its Director reported to the University Vice President of Finance and Administration and the Chancellor of the Bloomington campus. When this Vice President resigned in 1991, the University President created the Office of Information Resources (OIR) and the UCS Director became the University's chief information officer with the title of Associate Vice President for Information Resources.

The OIR recommends policies and standards, and coordinates computing, video, and voice technologies, networks, learning technologies, and other information technology functions across the University. It has operational responsibility for telecommunications, printing, and University Computing Services. The Associate Vice President for Information Resources reports to the University Vice President/Chancellor of the Bloomington campus and of the Indianapolis campus.

UCS today faces another organizational transition. The Associate Vice President for Information Resources recently assumed a similar position at another institution. With an acting Associate Vice President for Information Resources and an acting Director in place, a search by committee is underway.

Mission and Organizational Structure

UCS' mission is to create an excellent computing and electronic information support environment for scholarship and the service functions that support it. UCS seeks to facilitate the highest quality research, teaching, and learning; to provide access to higher education for Indiana residents; and to enhance the state's economic development.

UCS is organized around the specific technology dimensions of its responsibilities and the support services that users require. The organization's structure is matrix-like and includes four vertical divisions that reflect the technology dimensions: Computing Systems, Information Systems, Network Systems, and Workstation Systems. Each vertical division directs its efforts toward the horizontal dimensions of the matrix. These include the respective technologies, technology standards, and planning; user applications; and service delivery. UCS' commitment to delivering effective user support calls for special emphasis; thus, the fifth vertical division is Computing Support Systems. It delivers services across all the primary technology areas and supports organizational administration and management.

Management Philosophy

Decision making at UCS is characterized by a participatory philosophy and consensus building at the senior management level. Before making decisions that have cross-divisional implications, senior management conducts discussion and invites input from mid-level and line managers. While this philosophy means more time is spent reaching decisions than in more centralized decision structures, these decisions receive greater support and are easier to implement. In addition, major project proposals follow a specified senior management review procedure, and are presented in a standardized format. This format includes the background of the problem, the recommended solution with rationale, alternatives to the solution, personnel and non-personnel resources, the impact on other divisions of the organization, how the project will be managed, and the implementation schedule. This format and process together ensure that the information needed for consensus-based decisions is available, and that all relevant individuals are included in the process.

Each senior manager is a UCS associate director (AD), responsible for one of the five divisions. Decisions that affect staff or projects in each division are decentralized to the respective AD who has full budgetary and hiring authority in the division.

Strategic Planning and Management Processes Overview

When UCS was formed, senior managers were faced with a large organization (250 FTE, 150 PTE) whose collective management processes were disjoint and disorganized. The organization needed a rational, coherent process to track resources from allocation to implementation. To help implement integrated management processes, the UCS Management and Planning Systems group developed a handbook called *UCS Management Processes Guidelines and Calendars* . This is updated and distributed to all senior and line managers at the beginning of each fiscal year. The handbook includes:

- A fiscal year calendar of the annual management cycle (Figure 1). This provides a snapshot of the timelines for planning, budget preparation, personnel management, and advisory functions, and shows the links between the management processes.
- A detailed schedule of the management process timelines, advisory committee meetings, and the academic calendar.
- Detailed management process guidelines for updating the strategic plan, developing division implementation plans, reporting progress on objectives, constructing the base budget, producing the annual report, and completing performance reviews and development plans.

UCS Organizational Management Cycle (FY92-93)

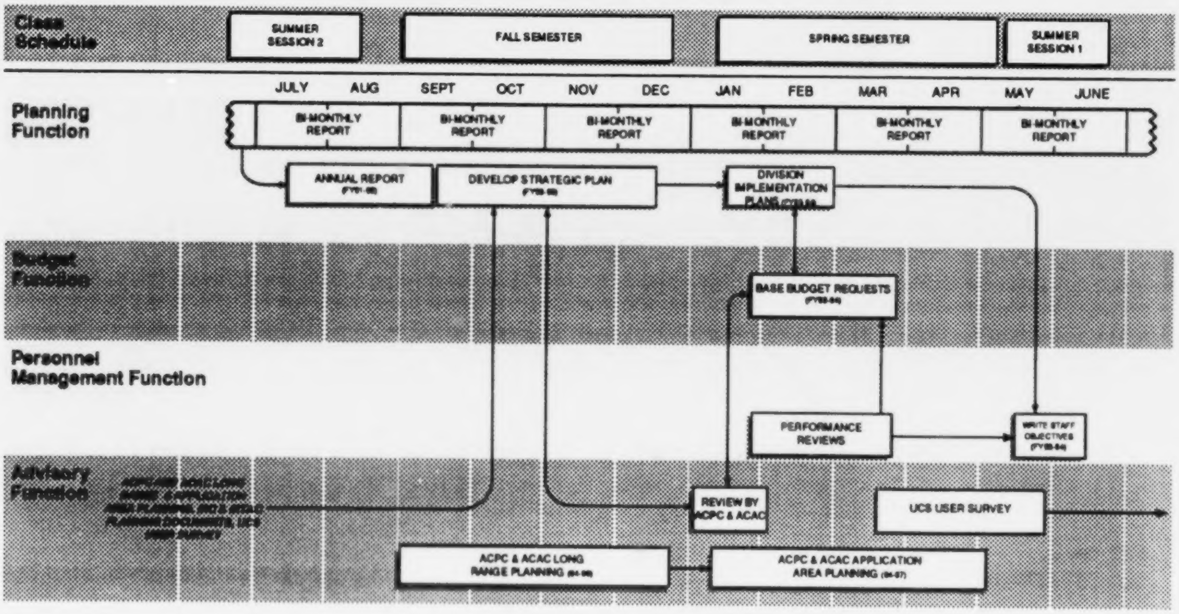
Class Schedule
SUMMER SESSION 2
FALL SEMESTER
SPRING SEMESTER
SUMMER SESSION 1
JULY
AUG
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
Planning Function
BI-MONTHLY REPORT
BI-MONTHLY REPORT
BI-MONTHLY REPORT
BI-MONTHLY REPORT
BI-MONTHLY REPORT
BI-MONTHLY REPORT
ANNUAL REPORT
DEVELOP STRATEGIC PLAN
DIVISION IMPLEMENTATION PLANS
Budget Function
BASE BUDGET REQUESTS
Personnel Management Function
PERFORMANCE REVIEWS
WRITE STAFF OBJECTIVES
Advisory Function
REVIEW BY ACPC & ACAC
UCS USER SURVEY
ACPC & ACAC LONG RANGE PLANNING
ACPC & ACAC APPLICATION AREA PLANNING

Figure 1

THE STRATEGIC PLAN

In a climate of environmental change, organizations must be especially proactive in determining their goals and objectives, and discovering the best means of allocating resources to achieve them (Keller, 1983). A primary tool for addressing these issues and improving an organization's ability to perform its mission is strategic planning.

The importance of strategic planning for information technology has been established and extensively explored over the past decade. Information technology organizations exist in a constant state of change caused by rapid and continuous technological advances and the ever-growing sophistication and demands of their user groups (Penrod and West, 1989). Strategic planning can boost their chances of surviving in that environment.

UCS Strategic Planning Processes

In 1989 over 30 senior administrators and managers, with considerable staff and user input, prepared the first UCS strategic plan. The planning process and resulting document set out the organization's vision, goals, and objectives.

In the two years that followed, UCS used two different processes to write annual updates to the plan. In 1990, a staff member working with senior management composed the first draft. The draft was then distributed to the manager's for review, discussion, and refinement. A more participative and collaborative process was used for the 1991 update. Senior administrators attended a strategic planning retreat where they drafted a revised set of strategic goals, objectives, and priorities. This draft was forwarded to a

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planning team of representatives from each division who wrote a Strategic Plan Update reflecting UCS strategic goals and objectives in language and format that was accessible to both staff and users.

UCS has not yet determined the specifics of the 1992 strategic planning process, in part because the organization is in a transition between a permanent Associate Vice President and a permanent UCS Director. When permanent leadership is appointed, we will most likely develop a new strategic plan rather than update the original one.

Advisory Committees — Their Structure and Input

Key in any strategic planning model is identifying the needs and values of the organizational stakeholders and constituencies and building them into the planning process (Bryson, 1988). UCS seeks guidance from users and clients on priorities and policies through two advisory committees. The university-wide Administrative Computing Advisory Committee (ACAC) is a body of administrators, professional staff, faculty, and students who focus on IU's administrative functions. The Bloomington-campus Academic Computing Policy Committee (ACPC) focuses on that campus's academic functions. This committee includes faculty members, UCS staff, and student representatives.

Both committees take part in IU's technology planning by establishing long-range (five-year) plans in several major areas of academic and administrative computing. The ACPC also develops short-range (one year) plans in several specific application areas. These groups play an important role in UCS strategic planning and budget prioritization; their plans help UCS refine its strategic goals and objectives.

IMPLEMENTING THE STRATEGIC PLAN: TRANSLATING STRATEGY INTO ACTION

UCS translates its strategic objectives and the organization's operational objectives into annual implementation plans for each UCS division. These plans guide each division's actions toward accomplishing UCS operational and strategic objectives for the next fiscal year.

Senior management collaborates on developing the plans and collectively reviews them at the end of the process. This level of attention helps management identify and assign the division and cross-division objectives that feed into UCS strategic and operational objectives. It also helps them identify and coordinate crucial timelines and staffing requirements for division and cross-division projects. Most strategic and operational objectives are cross-divisional; making the appropriate linkages among divisions ensures that the organization's collective efforts will work in harmony.

Senior management identifies the divisions responsible for each of the strategic objectives. Each division then outlines its implementation plan. These plans include the division's operational activities and resource estimates; strategic objectives and projects, with resource estimates for accomplishing them; activities and timelines that could affect the division's ability to complete the projects; and an outline of project items that involve personnel or non-personnel resources from other divisions.

With the division implementation plan mapped out, work groups in the division develop their plans. These plans describe projects and activities in more detail and provide the linkage between division plans and staff objectives.

LINKING STRATEGIC PLANNING TO THE BUDGETING PROCESS

Once the organization's strategic vision is expressed as a set of strategic objectives, and these objectives are expressed as division-level objectives, an organizational budget is derived. This is a critical part of strategic planning, for nowhere are an organization's priorities more clearly set out than in its budget. The budget is the mechanism most amenable to serving as an implementation tool for the strategic plan.

The strategic planning literature pays little attention to this stage, perhaps because of the difficulty of aligning the strategic planning and budgeting processes. Yet neglecting this stage will diminish an organization's effectiveness, especially when funds are tight and organizations must be sure their support goes to the highest priority objectives.

Difficulty of Aligning the Budget Process with Strategic Objectives

Three factors contribute to this difficulty.

- Most organizational budgets are compiled by division. But strategic objectives tend to cross-cut divisional boundaries. Cross-division complexities make it difficult to maintain a one-to-one correspondence between budget lines and strategic objectives.

- Organizational budgets tend to be constructed as line-item budgets rather than program budgets. Since planning strategies are generally directed at policies or programs, the line-item budget is at odds with the products of the planning process. Strategic planning strategies do have line-item implications, but these should be derived by careful analysis of the programs and projects that are part of the strategies.

- The inertia of the budgeting process itself should not be taken lightly. Most processes have been in place for some time, often with stakeholders who resist changes that could affect their position in the competition for scarce resources. This aspect of strategic planning is rightfully seen as a threat to any part of the organization that is not furthering strategic objectives.

The UCS Budget Process

UCS' mechanism for integrating the planning and budgeting processes is central to the success of our implementation process. Following are some keys to this success:

- Many objectives require us to coordinate resources across two or more divisions. Associate Directors handle this coordination before the budget is constructed, during the division implementation planning process. The coordination continues throughout the project, with one Associate Director designated as coordinator for each strategic objective.

- The UCS budget is a program budget. Each organizational objective or ongoing activity is designated as a project (or program), enabling us to manage the resources for accomplishing each one. Many projects are defined directly from an objective in a division implementation plan.

- The project budget is constructed bottom-up. Each division first compiles its budget with significant interaction between managers, staff and Associate Directors. These division budgets are merged into an organizational budget and submitted to the administration of the campus and the University. Working bottom-up, UCS can manage and track projects that cross divisions and rapidly reallocate resources to new projects each year as the environment and our clients' needs change. An automated information system manages the budget. It's built to take advantage of the benefits of the program budget, while being flexible enough to manage costs by line item within and between programs.

GUIDING DAILY STAFF ACTIVITY TO STRATEGIC ENDS

The Importance of Staff Participation

It is not enough to link a strategic plan to the budget process. It is only when each staff member tailors everyday decisions and actions to supporting the organization's strategic goals that these goals and objectives can be achieved. Successful strategic planning processes involve staff participation. As service deliverers, staff are the true "front end" of an organization, so must share ownership of and commitment to strategic objectives. Many otherwise well developed strategic plans have foundered from failing to carry the elements of the plan into the day-to-day activities of the organization's staff.

Deriving staff performance objectives is a key part of putting a strategic plan in place. One good way to involve staff is to have them participate in developing their performance objectives. At UCS work group managers and staff share in this process. Some managers even ask their staff to provide the first iteration of their performance objectives, based on the work group plan.

UCS Staff Performance Review and Development Plan

The performance review document is a written guide to the activities staff should undertake to implement the organization's strategic objectives. It also shows the relative priority of the employees' various responsibilities in enabling these objectives. When staff help identify and refine their objectives, they have a chance to interact with managers and directors to clarify their role. The performance review is a vehicle for a "management by objectives" approach to implementing the plan. The UCS approach most closely resembles the management by objectives philosophy (Rodgers & Hunter, 1992).

The two-part UCS performance review process is called a "Performance Review and Development Plan Process." Both parts are conducted in writing at least twice a year; with frequent manager and employee discussions on objectives occurring during the year.

The first part of the performance review, completed by staff and manager, evaluates staff performance on strategic and operational objectives for the preceding year. It helps guarantee follow-through and accountability on the organization's goals and objectives. The second part of the review is the written development plan in which employee and supervisor set next year's objectives, again based on the division and work group implementation plans. Objectives in the strategic plan are decomposed to the division level, then the work group level, and finally to staff objectives (See Figure 2).

ENSURING ACCOUNTABILITY THROUGH REPORTING ON OBJECTIVES

Once an organization identifies its objectives in strategic and division implementation plans and in individual staff performance objectives, it needs an accountability mechanism to track progress on those objectives for the year. UCS uses a bimonthly reporting process. The reports are kept brief — three pages for each division to reduce administrative burden on managers. Included are sections on progress (and exceptions) toward key strategic and operational objectives and performance measures on key indicators of service quality.

The reports are constructed through a bottom-up process. Each staff member reports on individual objectives to his or her supervisor, who, in turn, reports to the managerial level above, and so on, through to the top of the organization. The bimonthly reports are placed on an organization-wide file server where all staff can read them. At year's end, the information is consolidated into an annual report on progress toward goals and objectives and is distributed to our clients.

The combined bimonthly and annual reporting process:

- Provides accountability and tracks progress on objectives for all staff and the organization.
- Communicates progress on objectives, alerting management to objectives that need attention, such as deploying different levels of resources than were originally planned.
- Communicates information among managerial levels, across division boundaries, and to our clients.

As an example of the outputs from the UCS Management Processes for FY92-93, Figure 2 displays a decomposition of strategic objectives through the staff member objectives and the reporting process.

INTEGRATING STRATEGIC OBJECTIVES: A UCS EXAMPLE

University Computing Services Strategic Plan Update (1992-93)	Goal 1: Develop and provide distributed computing services and applications for Indiana University. Develop a networked workstation-based computing environment. Objective 2: Implement distributed services, including the migration of faculty, students, and staff to workstation-based mail and conferencing.
Computing Support Services Division Implementation Plan (1992-93)	a) In conjunction with the Program for Distributed Computing, Computing Support Services will develop and provide the support services required for the delivery of distributed services and the migration to workstation based mail and conferencing. 1) The Education Program will develop and provide computing classes on the new distributed computing environment applications.
Education Program Staff Member Staff Performance Objectives (1992-93)	a) Develop 2 new *JumpStart* classes to support the introduction of the distributed computing environment. Offer these classes 8 times each during the fall semester.
Education Program September - October/1992 Bimonthly Report	With the assistance of the Program for Distributed Computing staff, completed the development of 2 new *JumpStart* classes, one on the PC platform and one on the Macintosh platform. Eight PC classes and eight Macintosh classes are currently scheduled to be offered during the fall semester.

Figure 2 How a UCS strategic objective is translated through each of the management processes.

MANAGEMENT PROCESS ISSUES

While this planning and management process has helped UCS cost-effectively deliver and improve services in a time of budget cuts, four major issues remain.

Staff resistance can be a problem in introducing new planning and management tasks. In technology organizations where there's more to do than is manageable in a 40-hour week, staff can view these processes as too time and labor intensive. The utility of each management tool may not be apparent to those used to spending time on technical issues. The UCS executive director and senior management devoted a great deal of time and energy to getting UCS to adopt the new process. During the first year, particularly while the new procedures and tools were being developed, the executive director had to enforce deadlines, even for senior management. But the consensus building aspects of the strategic planning process and management and staff commitment to the strategic objectives helped put the integrated planning and management process in place. Without such a commitment, this would have been much more difficult. We continue to struggle to find the right balance between spending time on planning and spending time on actually delivering our services.

Managing large complex projects that require coordinated efforts by two or more divisions is another problem. Our organizational structure is designed to help us easily realign resources to address cross-divisional projects. But a formal matrix management approach, which empowers project managers with responsibilities that run horizontal to the normal vertical hierarchy of divisional authority, has not been adopted. Given the stressful environment during the merger, UCS decided not to empower people as horizontal project managers. Instead, staff committees from all affected divisions handled coordination. Unfortunately, when the division objectives are not fully compatible, this coordination effort often fails.

As we integrated these processes into our organizational structure, we often considered the benefits of some aspects of total quality management (TQM). These processes and tools are consistent with weaving TQM into the fabric of our organization, and we continue to evaluate the usefulness of TQM for our organization.

For many years the only mode of operation higher education organizations knew was growth and expansion. By contrast, one of our biggest challenges today is prioritizing what we ought to *stop* doing. This remains a problem for UCS because there are few clear-cut mechanisms for prioritizing what we should drop. We are more comfortable dealing with fiscal and personnel constraints by making minor refinements to our suite of services. But some progress has been made this year by including our advisory groups directly in the decision-making process.

BENEFITS OF INTEGRATED PLANNING: CONCLUSIONS AND IMPLICATIONS

In our three to four years' experience using and refining these planning and management tools, we've reached several conclusions that have implications for computing technology organizations. These implications are general enough to apply to most public sector organizations.

Increases Organizational Efficiency, Effectiveness, and Accountability

Integrating an organization's planning, budgeting, performance review, and reporting processes increases effectiveness, efficiency, and accountability. At UCS improved efficiency is one of the major benefits. By ensuring that a higher percentage of organizational decisions and staff activities align with strategic objectives, we pare wasted effort and inappropriate managerial decisions.

Beyond this, the organization's effectiveness is enhanced. This comes in part from freeing staff time from tasks that are neither strategic nor required for day-to-day operations and gearing staff activities to "doing the right things" instead of "doing things right." The integrated approach makes it easier to trace the relationship of individual decisions and actions to strategic objectives and the organization's mission, and improves accountability to client groups and the University administration. These benefits are especially important in an era of reduced funding.

Ensures Operationalizing the Strategic Plan

Integrated planning and management enhance an organization's ability to operationalize the strategic plan and safeguard the quality of its services. They help translate strategic objectives from the highest levels of management to the levels of day-to-day staff implementation. When staff are explicitly included in developing the strategic plan and performance objectives, they become part owners of the strategic objectives. This ownership builds commitment to these objectives, and helps staff deliver services consistent with the plan. Ownership carries over, too, to the organization's clients. UCS clients are involved in the strategic planning process, and, through a number of advisory committees, in many UCS operational decisions. This represents the UCS effort, in terms of Peters and Waterman's book *In Search of Excellence*, to "stay close to the customer."

Provides Cost-Effective Management Processes

Cost-effective integration of these strategic planning processes and management tools can be achieved with a surprisingly low overhead. The initial development required UCS to commit between 1.0-1.5 professional staff lines for about one year. Even this commitment is a minimal investment for the potential return. We hope these tools can provide a template other computing organizations can tailor for their own use. Once these processes and tools are developed, the most difficult task is convincing senior and line management to follow the process timetables and use each management tool appropriately. This is no trivial task, but effective leadership and a participatory strategic planning effort can produce the required commitment.

The first year an organization applies this planning and management process will demand more effort from managers and staff than traditional management. But once the integrated process is in place and managers and staff know what to expect, the overhead for maintaining the process is considerably less than the effort of budgeting or doing performance reviews without such a framework.

Accommodates Different Management Styles

These management processes are flexible enough to be used by a diverse group of managers with different styles and management needs. UCS management groups vary greatly. Some managers use a large number of control or intervention devices with their staff, while others prefer more laissez-faire approaches. These tools can accommodate this range of style.

Responds to Changing Needs

One of the main purposes of strategic planning and management is to help an organization respond to changing environmental conditions and client needs. We saw this proven at UCS when our executive director resigned and the organization was able to continue addressing its strategic goals. Such a loss of leadership could have caused severe problems had not clear organizational directions been in place. The particular strength of these directions was their tie-in with strategic objectives, division implementation plans, workgroup implementation plans, budgets, staff objectives, and performance review processes.

GENERALIZING THE PLANNING PROCESS

It is our experience that these integrated strategic planning and management processes and tools can be shared and generalized to other institutions. They can help institutions of higher education address the transition to reduced budgets, increased service demands, greater competition, and increased accountability. And they can help organizations turn these times into opportunities for improvement, rather than a series of intractable problems.

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Making Decisions With Shrinking Resources

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Abstract

Information Service groups providing campus technology resources must operate with an understanding of the critical issues facing Universities in the current decade. Alignment of decisions regarding priorities in Information Services with key national issues such as academic excellence, curriculum reform, renewal of facilities, and rising library costs, is essential. This paper looks at the changing role of Information Services on university campuses and presents decision making strategies and alternative resource reduction plans.

Making Decisions with Shrinking Resources

I. Introduction

It is likely that higher education will remember the 1980's as the beginning of the technology revolution on campus and the 1990's as a decade of rising costs and shrinking resources. For providers of technology services, on campus, the challenge for the 1990's is to make technology a part of the management solution, instead of a part of the budget problem. Recent reports have shown serious decreases in state support for higher education[1]. It is also clear that if any new funding arrives on campus it will not necessarily be reapplied to areas receiving budget cuts during the last two years. However, based on findings in a recent EDUCOM - University of Southern California's Center for Scholarly Technology survey[2] colleges and universities still expect to increase spending on technology.

Strategic decisions about technology should be focused on the application requirements for the future. For example, in the year 2000 students will arrive in campus residence halls and "dock" their computers onto the campus network. The network will send welcoming messages to each student, review the courses they have been registered for, present reading lists and course syllabi, and review the status of any outstanding financial obligations that the student may have. Faculty will come into their offices and expect the network to download messages (which might include voice, video, text and fax). Results of large research applications running on the network would also be available as well as class homework assignments and graduate student application fol ders awaiting review. For campus administrators the network would provide easy access to financial information such as expenditures and investments. Deans and department chairs would have access to personnel budgets and supplies expenditures.

Information services and technology resources must understand and be part of the broad issues facing universities in this decade. Knowing the above requirements, and understanding that limited resources are available, there are several key issues that can become opportunities for technology resources to grow while furthering the overall campus mission.

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[1] "1%Decline In State Support For Colleges Thought to Be First 2-Year Drop Ever," The Chronicle Of Higher Education, 21 October 1992, pp. A21, A26.

[2] "36% of Colleges and Universities Plan to Increase Spending on Computing; 31% Expect Declines," The Chronicle of Higher Education, 4 November 1992, pp. A17-A18.

A first priority is continued academic excellence. Universities will continue to be dependent on the quality of their faculty and students. Working against these principles are larger classes and fewer faculty. Maintaining a state-of-the-art technology environment is an obvious way to strengthen a campus's competitive edge when recruiting faculty and students. However, this process must be redefined in the 1990's to include a plan for updating and replacing equipment on a regular basis with a move away from large one-time purchases which become obsolete quickly.

Using technology to bring classes closer together can be fostered by creating "electronic study groups". At the State University of New York at Binghamton, electronic study groups (discussion groups using electronic mail) are formed automatically for faculty, upon request, for a course. The members of the study group are determined from the class registration database. A faculty member can communicate assignment and review material to the group. Students use the electronic study group to discuss class work and communicate with their peers. The technology removes the requirement of everyone being in the same place at the same time and does not require presence on campus to participate.

Universities are continually moving forward to strengthen undergraduate education and concomitantly reform the curriculum. These efforts present opportunities to integrate resources such as multimedia tools, interactive classrooms and network accessible information. Increasing awareness of existing technology resources on campus and expanding availability to new sectors of the university community can provide support to the learning environment with little additional cost.

II. Strategic Alliances

All of the application requirements for the year 2000 mentioned above stress the underlying importance of a well-planned campus network. It is clear that current decision making should put high priority on providing network access to all members of the campus community. Completing the network is also the first in a series of eleven recommendations about technology resources recently sent to campus presidents in a report from the HEIRAlliance on the Integration of Information Technologies on Campus[3].

Although resources are limited, one way to launch new initiatives or complete existing projects is through strategic alliances with other campus service providers. An alliance with the Maintenance and Facilities department can support and fund the completion of the campus wiring plant while the Maintenance and Facilities department helps the campus address the issues of deferred maintenance and the required renewal of facilities. Working with Maintenance and Facilities can include planning for a new building with network access to all laboratories and department offices. In addition, classrooms can be prepared for students who carry small notebook computers by providing power and network access at all desks. Projection equipment, podiums for computer resources and multimedia tools can be designed into large and small classrooms. Any major remodeling job on campus can be enhanced with network access. Strategies can include low cost solutions that capitalize on existing copper wire in older structures as a transition point to eventual new network facilities.

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[3] HEIRAlliance, "What Presidents Need to Know... about the Integration of Information Technologies on Campus," HEIRAlliance Executive Strategies Report #1, CAUSE, September 1992, pp. 1-4.

A second critical strategic alliance should be formed with the university library. In aggregate the library at the State University of New York at Binghamton is now the largest user of central computing facilities. Libraries are faced with serious increasing costs and fewer actual dollars of spending money. As libraries look to enhanced network services to strengthen the capabilities of interlibrary loan and other shared resources, the PACLink project now underway at three State University of New York campuses and eight Indiana campuses will link end users to multi-campus library resources. This software, when complete, will facilitate patron access to remote catalogs and will offset labor intensive back room operations in the library. Computing Services staff have worked with other areas in the library to provide new tools to reference librarians and to enhance network access for all library patrons[4]. The entire campus community benefits from excellent library services.

Technology can be deployed on campus to avoid an increase in administrative support staff. For example, several campus administrative offices are responsible for collecting money from students. These offices may handle cash, credit cards, or university credit cards but in all cases a record of payment must be entered into a computer system and a receipt must be printed. Computer software can be redesigned to give university administrators the option of combining these functions into common locations, under one management. New technologies, such as automatic teller machines (ATM) can be designed to handle financial obligations on the university network.

Services like automated degree audit programs can accommodate frequently asked advising questions by providing reliable information to students. Advising staff can focus their attention to the more difficult, less commonly occurring academic situations. Output from degree audit programs will improve planning for academic departments. Information on the number of majors yet to complete various courses in the major sequence is a critical long range planning tool for deans and department chairs. Along with this information, output from demand based registration systems helps university administrators to deploy scarce salary dollars to hire adjunct faculty when course demand warrants.

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[4] Geraldine MacDonald and Andy Perry, "Information Access Computing Services and Libraries: A Joint Offensive Team," Proceedings of the 1990 CAUSE National Conference, November 1990, pp. 395-402.

III. Future Planning Strategies

Campus budget cuts cannot easily hold an individual unit such as computing services harmless from resource reductions. Information resource providers already stretched to the limit are finding staff layoffs and hardware and software reductions difficult to absorb. Careful analysis of long term expenditures can provide valuable information to manage with reduced resources. Fig. 1 demonstrates the rising cost of computer software when compared to the overall computing budget at Binghamton. Selective cancellation of low use licenses, consolidation of duplicate licenses, aggressive pursuit of campus site licenses and vendor software consortiums can help to manage long term costs.

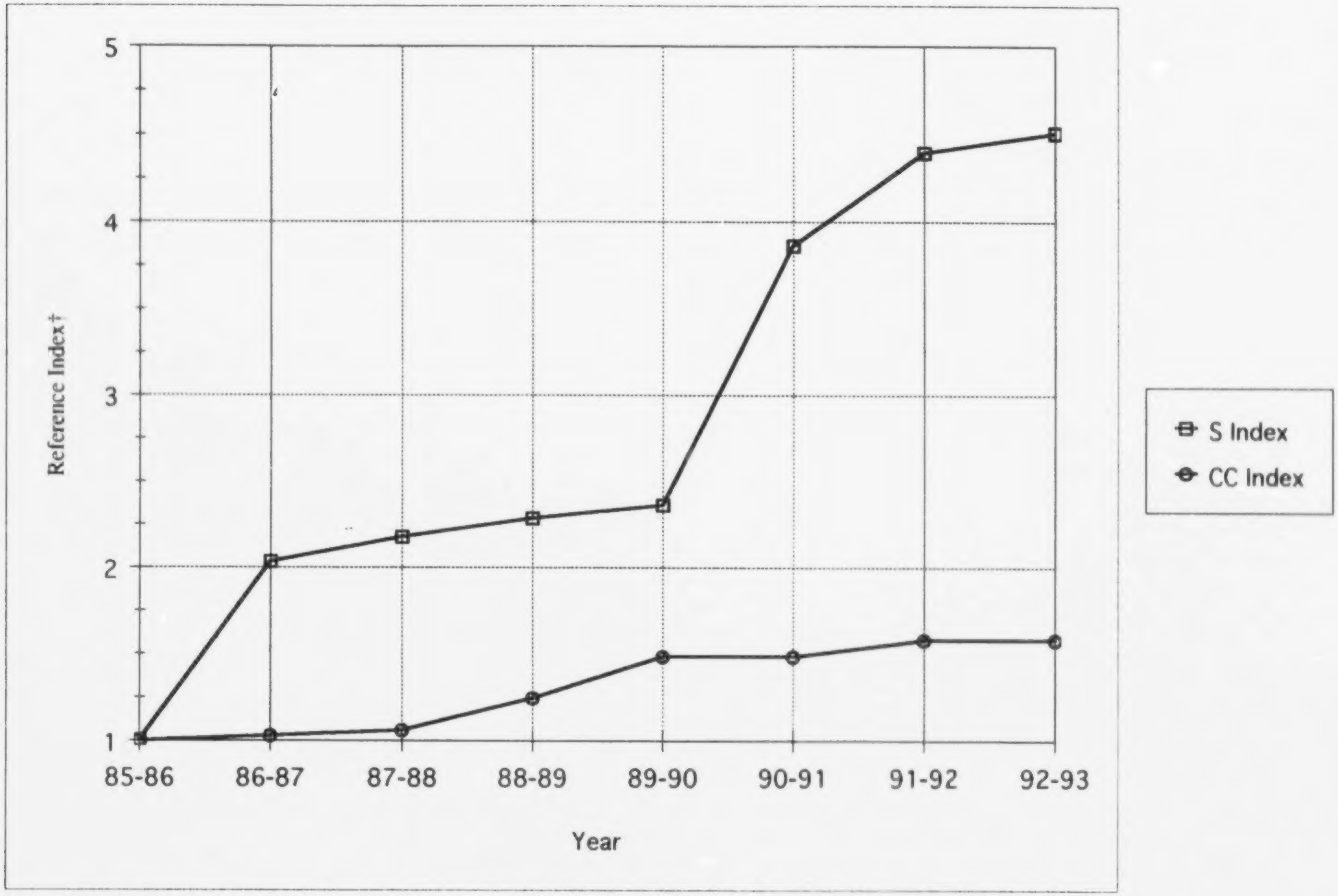
Fig. 2 demonstrates that hardware maintenance costs are also rising at a rapid pace. Although the industry is moving away from large central systems the aggregate maintenance of many small machines is impacting long term costs. Selecting a few campus standards to be maintained by in house technicians helps to control costs for all campus units. Purchase costs of new equipment must include the costs of repairs and consider seriously the value of extended warranties in reducing the cost of ownership.

Staff layoffs can be somewhat mitigated by using an industry model which discontinues subcontractors before terminating long term full-time employees. At universities part-time student employees can be viewed as subcontractors. Cutting back on student employees will require full-time programming staff to take on additional duties but will maintain a core of trained personnel. Replacing student consultants in computer laboratories has both positive and negative results. On the negative side professional programmers are diverted from their regular tasks thus lengthening some project deadlines. On the positive side, professional programmers are exposed to the vast diversity of applications and users across the campus. This new knowledge has the potential to improve overall computing services as new techniques are applied to on-going programming projects.

IV. Conclusion

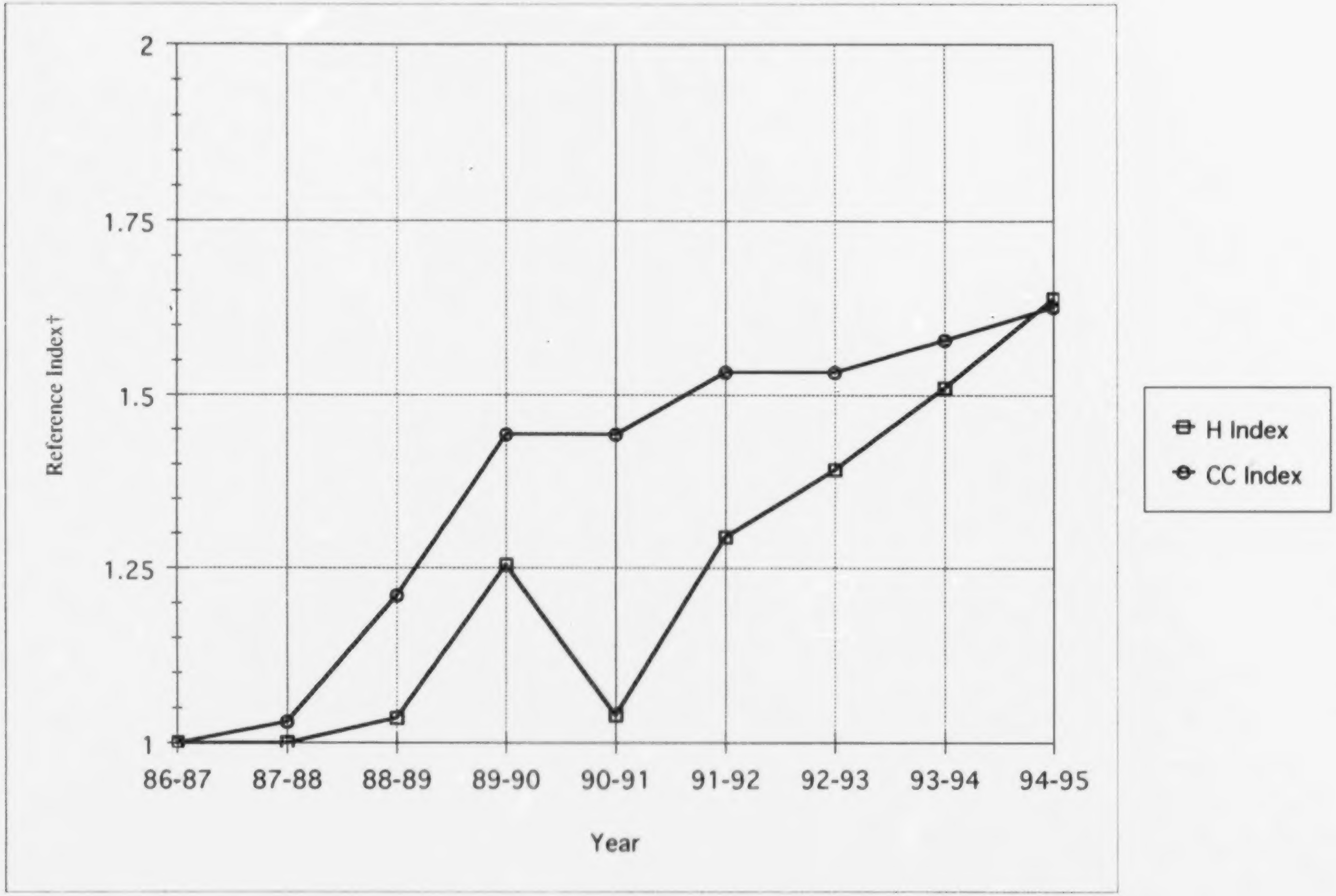
Managing with shrinking resources presents many challenges but should be viewed primarily as an "opportunity in adversity". Software and hardware reductions present an opportunity to eliminate the trailing edge. Reorganizing consulting services and staff responsibilities can result in better services to the entire university community. Fostering strategic alliances with other campus units can support new initiatives.

ANNUAL COMPUTING SOFTWARE COSTS†



†All numbers indexed from 85-86 figures

ANNUAL COMPUTING HARDWARE COSTS†



†All numbers indexed from 86-87 figures

The Case for CASE

by

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Faced with the dilemma of aging systems and declining budgets, Arizona State University has begun exploring CASE technology to assist in solving the problems of maintaining old systems while developing new ones. The facts we have discovered about CASE tools and the cultural adjustments required are presented within the context of five pilot projects we have completed using CASE.

The Case for CASE

Introduction

The Administrative Information Technology (AIT or IT) office of Arizona State University (ASU) is caught on the horns of a complex dilemma. Budgets are shrinking and, as a unit with a large budget outside the immediate academic mission of the university, IT is likely to experience larger budget reductions than other areas. Add to this the fact that other offices with diminishing resources are expecting IT to provide technological relief from the service reductions they are facing. Thus, one horn of the dilemma is that we are being asked to do new things without reducing current services and without new resources.

Another horn began to grow ten to fifteen years ago when our current legacy systems were installed. The design technology of the time did not anticipate the enormous maintenance burden we would inherit nor did it anticipate the ways in which "business changes" would stress the systems. For example, when the Student Information System was built, ASU was a single campus. It has now grown to two campuses with discussions about a third. Two years have been spent working out a way to implement a campus identifier. We are in a situation where keeping the current systems operating takes the lion's share of diminishing resources while we agonize over the fact that the systems do not meet the needs of the University anyway.

A Management Perspective

- There is no money and the budget reductions will continue for at least another two years

- Demand for technological support for other areas with diminished resources will continue to grow.

- Maintaining old systems takes too high a percentage of available IT time.

- The systems being maintained do not meet the needs of the University but cannot be abandoned during replacement.

- The code has been maintained heavily for so many years that it is becoming unmaintainable.

- New systems take too long to build and packages require extensive modifications to meet business needs.

- Data is very difficult to retrieve even for trained programmers at a time when clients are demanding easier access to more data .

- Clients are pressing for a "distributed" computing environment which they hope will solve the problems.

A steady diet of such stress breeds a climate of civilized antagonism. Customers begin to think that IT personnel simply do not know how to solve problems. IT people feel unappreciated for they work they do and frustrated by being unable to make real headway in providing solutions the clients will like.

Managing in a climate like this is "challenging" to say the least but, there is hope that technology itself may provide some help. Like the "shoemaker's children", AIT folks have had little help from their own business. Recently, however, tools which can help automate the automation process have been maturing and can now support (1) the systems development process (CASE) and (2) reverse engineering which may make old systems easier to maintain through automated documentation and redesign. When contemplating the introduction of new tools, management is concerned by three major questions.

Management's Major Questions About CASE

- What will the new tools actually do?
  - How much would productivity increase?
  - How much faster would systems be developed?
  - How much better quality would new systems have?

- What environmental changes will be required?
  - What kind of training would be needed?
  - Would new methodologies be required?
  - How does one provide a "data orientation"?
  - What new management principles might be required?

- How much does it cost?

The CASE Environment and Experience at ASU

CASE tools have been finding their way into IT at ASU for several years but their *presence* had not been loudly announced. Computer Information Systems (CIS) had purchased an early version of IEF from Texas Instruments but had not employed it in any *official* projects. Later the KNOWLEDGEWARE ADW Toolset was purchased and CIS conducted a pilot project which delivered a working Cashiering System. Database Administration, frustrated over the difficulties encountered with each database modification, had arranged for the BACHMAN tools to be explored. The BACHMAN tools promise a path to gaining a better understanding of the current database structure as well re-engineering possibilities. A newly formed office, Data Administration, having almost no resources, purchased DEFT as a tool to help with enterprise modeling. All of these initiatives were made without an overall plan and this has caused some confusion about which is the most likely tool, whether more than one CASE tool can be accommodated in our environment, etc. It does show that there was a groundswell of perceived need for CASE or CASE-like tools within IT. Figure 1 gives a synopsis of how ASU has courted CASE.

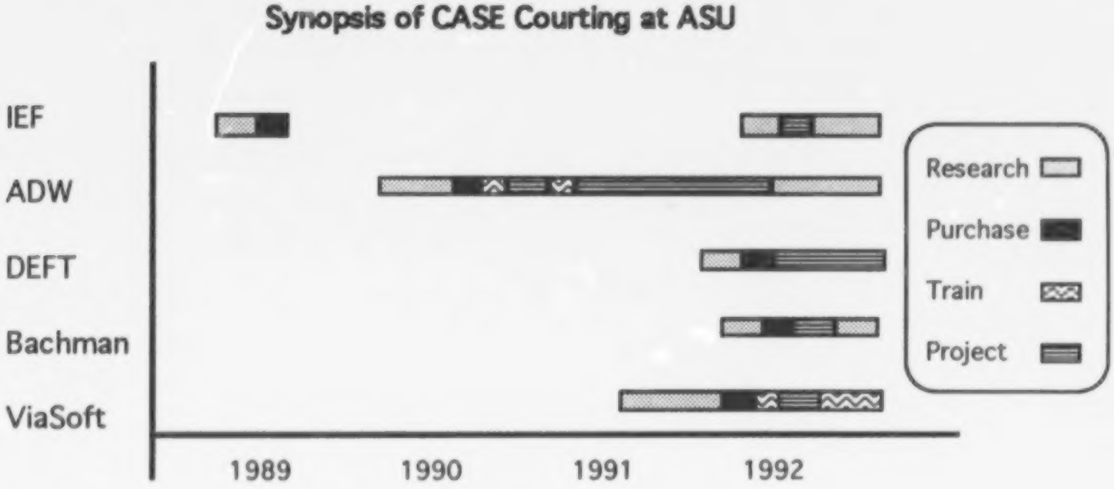

Figure 1

In March of 1990, a feasibility study on the replacement of ASU's Cashiering system (which was based on IBM 4700 technology) was made. The study recommended the system be replaced with a DB2/CICS application and approval was given in September, 1990. It was also decided to use this as a pilot project for KNOWLEDGEWARE and so a 12-person project team consisting of 3 IT staff and 9 client staff members was formed. The team, using KNOWLEDGEWARE and the Information Engineering methodology, completed their work in time to implement the system in March, 1992. The system delivered is a 26-entity, 115-attribute model with 116 associated action diagrams and 100 data flows. There are 6 relational databases, 28 tables, 26 files, and 347 data structures in its physical implementation. System functions are provided through 35 on-line programs and 28 batch programs with 35 screens and 13 reports. The project expended 5,942 man-hours which is nearly 3 person-years. Although this project was successful, ADW was clearly weak in the construction phase of the project. There was much more time spent in coding than was originally projected. The "specifications" looked strangely similar to COBOL.

At the time the ADW project was winding down, Texas Instruments, which advertises 100% code generation, announced the ability to generate to many client-server platforms. Since the overall direction of ASU is to "down-size" or "right-size" its applications, arrangements were made to conduct a proof of concept project. A five-day marathon session to test the IEF was conducted at the Texas Instruments headquarters in Dallas. TI employees worked with five ASU staff to create an Affiliate Information Management System. By the end of the fourth day, six relational tables and five on-line screens had been generated and tested in the mainframe environment. On the fifth day, GUI windows were painted, and without modifying any procedural specifications, the system was successfully re-generated for the OS/2 environment.

Data Administration began a Data Dictionary project for student information in July of 1991. Both BACHMAN and DEFT were used as tools. The BACHMAN tool supplied a diagram of the current physical Student Information System. DEFT served as the basic modeling tool and as a communication device among the 20-person dictionary task force. The project expended 1,140 person hours and delivered a Student Information Dictionary of 1,000 elements (each with 21 metadata elements) in December, 1991.

A second application of DEFT was made in the Summer of 1992 when Data Administration lead a 10-person project team in the design and construction of a Data Warehouse. This project delivered 110 relational tables (using Sybase) in an easily accessed (Data Prism and others) client/server (SUN 630 with 5+ gigabits of disk) environment. It also produced high quality E/R diagrams which are helpful in navigating the Warehouse and in training customers. The team took 116 days to design and implement the warehouse. This portion of the Warehouse contains ten years of student information. We plan to add Human Resource and Financial information by June, 1993 thereby providing ASU with an integrated management information source as well as access tools which can be used to build an Executive Information System.

The Viasoft project was initiated to address maintenance issues. It was sponsored by IBM and Viasoft to train five IT staff members to use the tools by re-engineering two nearly unmaintainable programs. The first was a batch program which was very inefficient. When returned to production it saved significant CPU time. The second program was an on-line program and its re-engineering resulted in the extraction of the business rules which now saves ASU 75% in maintenance time. The entire CIS staff is now being trained in its use.

What we Learned About the Tools and Their Use

The first lesson we learned was the extent to which each tool supports the life cycle of an application. Figure 2 shows where we see the strength of each tool with respect to this. The ViaSoft products are included in this analysis because they are tools which can help address the current maintenance problems.

Note that both KNOWLEDGEWARE and Texas Instruments provide a relatively full spectrum of support for the life cycle of applications and are the only tools which we examined that generate extensive code. IEF generates 100% of the code for all items contained in the diagrams they support. BACHMAN is largely an analysis and design tool but it is the only tool we examined which was capable of re-engineering (pulling an old database into a diagram then forward engineering it to a new environment). DEFT is quite useful as an analysis and design tool and does a creditable job in creating relational tables in several "popular" relational environments. ViaSoft is a good set of tools for making maintenance less troublesome.

CASE Tool Life-Cycle Support as seen at Arizona State University

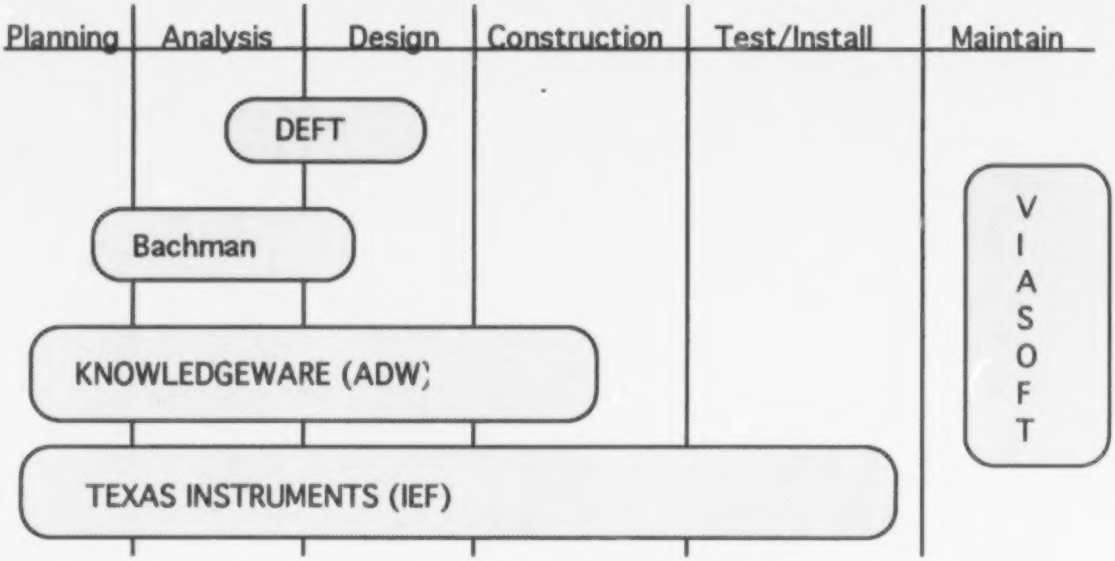
Planning
Analysis
Design
Construction
Test/Install
Maintain
DEFT
Bachman
KNOWLEDGEWARE (ADW)
TEXAS INSTRUMENTS (IEF)
VIASOFT

Figure 2

Another area of major interest to ASU was the minimum platform configuration requirements in which these tools would work. Figure 3 shows a basic comparison of what each tool needs to perform an adequate job.

CASE Tool Platform Configuration Requirements

Product	Platform	Memory	Storage	Oper. System	Other
Texas Instruments	IBM PS2 386	8Mb	115Mb	OS/2 EE	DBM/MFC
KNOWLEDGEWARE	IBM PS2 386	12Mb	115Mb	OS/2 EE	
BACHMAN	IBM PS2 386	12Mb	115Mb	OS/2 EE	
DEFT	MAC	8Mb	40Mb	System 6 (7 pref.)	
ViaSoft	MF:ISPF	n/a	n/a	n/a	

Figure 3

The projects with which these tools were tested were different but we have used our experiences to obtained some benchmark information comparing CASE development with third and fourth generation languages. In figure 4, please note that hours devoted to project management and training have not been included. We should also point out that the numbers are quite accurate and can be used to gain insight into CASE-supported activities. For example, one conclusion that can be immediately made is that CASE is not a panacea for a "no coding" requirement. Our own conclusions were that we should have spent more time in analysis. We believe this would have saved us substantial coding time.

Person-Hour Comparisons
Comparable Project Basis

Life-cycle Phase	3GL	4GL	CASE
Analysis	955	190	931
Design	1,260	1,125	1,302
Code/Test	3,789	3,739	2,445
Document	365	242	0
Total	6,359	5,296	4,678

Figure 4

Figure 5 is a comparison of the strengths, weaknesses, and costs of these CASE products. Each tool provided good support within the project(s) for which it was used but none of the tools were as mature as we would have liked. The assessment of strengths and weaknesses are those made by ASU and reflect how the tools met our needs. Costs are rounded retail figures and are included to give some idea of the financial commitment associated with a decision to use tools such as these.

Comparative Strengths, Weaknesses

CASE Tool	Strengths	Weaknesses
BACHMAN	Provides a warehouse of IDMS & DB2 databases. Performance & design tips provided.	Latest IDMS not supported. Weak IDMS-DB2 tool integration.
DEFT	Attributes on E/R diagram. Supports many RDBMS DDL.	Produces generic DDL. Slow to support RDBMS changes.
KNOWLEDGEWARE	Integrated repository. Reusable objects. Documentation automatic. Simple to use.	Code generation is weak. No testing facility. Weak maintenance link.
Texas Instruments	Integrated repository. Automated methodology. 100% code generation. Multiple environments.	Proprietary. Some difficulty in use. Weak print facilities.

Costs for these tools depend upon specific installation decisions but as a general idea they range from $10,000 to $500,000 for a basic system.

Figure 5[1]

When all cost factors are taken into account, CASE technology is seen to be quite expensive. Not only are the tools themselves costly, but the hardware, training commitments, and consulting expenses are substantial.

These costs and related issues create the third horn on our complex dilemma, it seems that we must do what we cannot afford to do.

In addition to the conclusions outlined above, we also noted many *cultural adjustments* which would have to be made in our environment if CASE were to be successfully implemented. These observations and conclusions are summarized in the next table.

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[1] Extracted from Joni Weber, "CASE Evaluation", Arizona State University internal report, May 1992.

Cultural Changes and Management Adjustments Required to Make CASE Successful at ASU

- Systems Analysts must also become *business analysts* . This implies training of a different nature and possibly working for a time in offices to really understand the daily routines and what the applications are being expected to support. This would include time spent with management to develop an understanding of their **true** *informational needs.*

- Use of these tools demands a data orientation to application development. Programmers and clients alike must be taught different behaviors in their use of data if CASE is to be successful. Data modeling must be initiated to ensure integration and minimize the duplication of data in our systems.

- There are three groups into which staff will divide themselves relative to the use of CASE. The Innovators want to be first and are anxious for change while the Cautious wait to see what will happen. The small percentage of Hold-outs are simply those who will never adapt to the change. This mandates a staff development program be planned with staff input and acceptance. Use of the tool(s) must begin immediately on smaller projects. Encourage experimentation and alternative perspectives.

- Everyone in the organization must begin to take a more holistic view of their functions and systems which support them. This is the only way to end the "stove pipe" syndrome from which our currents systems suffer. In particular, clients must become accepted members of the design groups and systems folks need to work hard to get them intimately involved.

- We must plan for training in both theory and tools. This means training in:
    - Data Modeling
    - Process Modeling
    - Relational Model Theory
    - Methodology - specifics
    - RDBMS/SQL - specifics

    and
    - the tools which will be used in all of these

- Most tools have a dictionary/repository but it is specific to the tool and not extensible. In a data administrated environment, this implies the use of a (possible distinct) single dictionary which is more flexible and the formation of work habits which will keep the dictionary updated.

- CASE is expensive and it takes more than money. It takes equipment, staff time and *commitment* ... especially from management.

Conclusion

CASE technology has matured to the point of enabling substantial improvements in applications development. Even with purchased packages, there are tools which can provide modeling capabilities robust enough to help make a better match between an organization's needs and what the package will supply. We conjecture that vendors will soon begin supplying models with their packages to more easily enable customization and maintenance. The greatest cautions which we have identified have been cultural and managerial rather than technological. Careful planning is required if CASE is to provide the benefits of which it is capable. It is vital that anyone contemplating CASE tools carefully identify where they wish CASE to take them and along which path. As is to be expected, this technology is expensive but the promise of *better, faster, more flexible* systems is very alluring and, when properly applied, CASE can help fulfill this promise.

REENGINEERED PURCHASING PROCESS

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Richard P. J. Duffett, Administrative Services
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Big Rapids
Michigan

This presentation will explain how Ferris State University is developing a reengineered purchasing process. In the development of the new process it became evident that there are really only two major stakeholders involved: the customer and the vendor. The customer has a personal interest in obtaining a quality product in a timely manner at a competitive price. The vendor is interested in providing good service and receiving timely payment. The new process is designed to empower the customer to deal directly with the vendor. Paperwork and bottlenecks have been significantly reduced while maintaining adequate control and accountability.

PROJECT OVERVIEW

Management consultants have long recognized an unusual dichotomy which exists in institutions of higher education between the expert teaching of current business management strategies in the classroom and the implementation of these strategies in administrative operations, which traditionally have been slow to evolve.

In recent years a multitude of social and economic factors have directly impacted institutional finances, forcing public universities to realize that business-as-usual can no longer continue. The costs of faculty and staff compensation, equipment, supplies, and maintenance of deteriorating facilities escalate while operating revenues fail to keep pace.

In Michigan, public universities engaged in strategic planning anticipate continuing cost increases and fluctuating revenues well beyond the 1990s. The national recession, Michigan's depressed economy, school finance reform, and tax shifts are among the factors affecting the level of State appropriations to higher education. Revenues from tuition may be reduced by a shift in enrollment from full-time to part-time students.

Ferris State University has a history of lean budgets which has necessitated creative and innovative approaches. The University now is increasing its efforts to improve administrative efficiency and effectiveness by using a management tool, Total Quality Management (TQM), which currently is popular in business and industry.

APPROACH

A Cost and Productivity Management Committee was appointed by the University President in August, 1991. The purchasing process was selected for intensive analysis because it is a complex process that impacts all campus units; therefore, the committee's work would have campus-wide visibility and impact. The timing was appropriate because improvements already were underway with the installation of an on-line computerized purchasing system. Process improvements could, hopefully, be implemented along with the automated system.

Fifteen committee members were selected to achieve cross-functional representation from all organizational levels and University divisions. The committee was divided into four teams; each team was assigned some members with prior understanding and experience in the processes being studied. These teams were: Purchase Order Initiating and Approval, Bids and Quotations/Order Processing, Receiving/Stores, and Accounts Payable/Fixed Assets/Stores Inventory Accounting.

As this was the first process review to be conducted at the University, an outside consulting firm was hired to guide the committee's work. The purchasing process was to be reengineered from the perspective of the "customer" - to design a purchasing process to fulfill the "wants" of each customer. Opportunities to streamline and improve the purchasing process were identified during each step of the analysis.

CURRENT PURCHASING PROCESS

The teams found that many parts of the purchasing process were slow and frustrating to customers, particularly if a budget problem occurred, a purchase order was missing, or a package arrived without proper identification. Customers also felt confined by excessive time requirements, multiple approvals, confusion over which form to use to initiate a purchase, and the inability to track the progress of a requisition through the system. Because of the time delay between initiation and issuance of a purchase order, they also felt their budget information was not accurate and timely. To compensate for the time lag in recording financial data, the end users maintained parallel, duplicate bookkeeping records. Duplication of effort and redundancy also existed in the area of receiving, in the maintenance of records by both the University's Central Receiving Department and individual departments.

In total, the current process included 405 activities from the point a requisition was initiated through the distribution of monthly reports, which provided a record of the charge of the purchase against the account. The number of activities required in cases of exceptions increased significantly. The teams determined that 143 of these activities added value to the purchasing process, and 262 added no value. Examples of non-valued activities included multiple approval signatures, transit time and redundant activities.

The number of verifications required in the normal process, between 20-25, was deemed to be excessive. The entire process required a maximum of 59 documents, of which as many as 12 were needed to get a purchase order issued. The teams also discovered a lack of understanding of the process, which suggested the need for improved communication and training.

ISSUES

Before examining ways to improve the process, the teams explored several new and different approaches to the purchasing process. This produced three foundational principles to drive the development of a new process:

1. Employee empowerment based upon decentralization of the process and accountability;

2. Elimination of non-value-added processes; and
3. Establishment of quality at the source.

Employee empowerment and process decentralization required removing perfunctory signature approvals. This necessitated making revisions in the balanced budget accounting process as well as increasing the accountability of individuals with budget or account manager responsibility as accurate, timely and appropriate information must be provided to the manager responsible for the cost center. A manager should be making purchasing decisions based on clearly stated goals, and then held accountable for those decisions. Process decentralization also creates a new role for the Purchasing Office, changing its function from processing requisitions to optimizing the institution's purchases.

Establishment of quality at the source is enhanced by an electronically based purchasing system which is user-friendly and real-time to provide all parties with the information needed to make better informed and quicker decisions regarding all purchases. This will reduce unnecessary budget transfers, reduce or eliminate invalid object code assignments, improve processing speed, and eliminate paper.

Paradigm shifts, organizational changes, enhanced teamwork and the removal of institutional barriers are essential for the implementation and success of the new process.

OPTIMAL FLOW

The overall philosophy behind the reengineered purchasing process is that only two major stakeholders are involved: the customer and the vendor. The customer has a personal interest in obtaining a quality product in a timely manner at a competitive price. The vendor is interested in satisfying the customer order by providing good service and receiving timely payment. The proposed process is designed to empower the customer to deal directly with the vendor whenever possible, thus satisfying another important vendor need to resolve any problems. Paperwork and bottlenecks have been significantly reduced while maintaining adequate control and accountability (see Exhibit A).

The reengineered process (Exhibit B) begins with initiation activities typically involving the identification of a need. Standard product descriptions, sources, and Ferris State University price information are published by the Purchasing Office for reference. In order to allow timely access and reduction of paper copies, office supply information is provided on the on-line campus-wide information system. The Purchasing Office provides additional assistance when required. Beginning in 1993, the customer will be empowered to enter requisition and receiving information directly into the new On-Line Purchasing system. Consistent with decentralized budget responsibility, only one approval level will be required.

Following approval, a requisition is handled in one of three ways, depending on the expenditure level:

1. Amounts of $250 or less are handled directly by the department with a new Purchase Order With Check (POWC) form. This new document empowers a department to make payment directly to a vendor, bypassing all of the traditional purchasing process steps. The department records this transaction on-line after the check has been cut. Appropriate controls guarantee accountability without adding processing steps.
2. Amounts from $250 to $3000 will be handled directly by the department through the use of the new On-Line Purchasing system. The system will generate a purchase order automatically upon electronic requisition approval. The purchase order document will be printed remotely on a LAN-attached PC printer whenever possible. Centrally printed purchase orders will be forwarded to the issuing department. In either case, the department will be responsible for communicating the order to the vendor. Electronic ordering opportunities are also being explored.
3. Amounts greater than $3000 will be handled by the Purchasing Office using the new bids and commodities module of the On-Line Purchasing system to reduce the time currently required by these activities.

Upon receipt of the purchase order (refer to steps 2 and 3 above), the vendor will be responsible for shipping the product directly to the requesting department. Terms, conditions, and prices (including shipping) are controlled by the Ferris State University purchase order. No price changes will be permitted after the order is accepted by the vendor.

The customer department will be responsible for the acceptance of packages, verification of goods received, and on-line entry of the information necessary to trigger vendor payment. Once the customer has electronically acknowledged receipt of the order, payment will be processed automatically based on payment terms associated with each vendor (i.e., net 10 days, 30 days, etc). Payment amounts are controlled by the original purchase order. Vendors will be instructed not to send invoices, and any invoices received will be discarded.

All of the accounting and descriptive information necessary to record a transaction will have been entered on-line during each step of the process. The optimal flow concludes with all detail and summary financial information available on-line.

Performance measures will be developed to monitor the process on a real-time basis to measure timeliness, and costs and quality, as well as to support the continued improvement of the process.

PURCHASING SOFTWARE MODIFICATIONS

The University's current On-Line Purchasing system has its origins in the implementation of Information Associates' Financial Records System (FRS) in 1983. IA's Human Resource System (HRS) was added in 1986, followed by the FRS Fixed Assets module in 1989. The need for an On-Line Purchasing system had been recognized for several years, but other University funding priorities delayed action until 1990.

At the request of the University Purchasing Department, a "build versus buy" purchasing system analysis was conducted in the winter of 1990. The following options were considered:

1. Buy Information Associates' On-Line Purchasing system
2. Buy purchasing software from another outside vendor
3. Build an interim/partial system
    a. Electronic mail requisitioning (bid items)
    b. Stand-alone PC
    c. Stand-alone mainframe
4. Build an in-house system with equivalent functionality

The need for close real-time integration with FRS and the Fixed Assets module eliminated other vendors and the stand-alone options. A preliminary analysis indicated that three-to four-person years of internal systems development effort would be required to meet minimum customer requirements with an in-house system. Upon completion of the analysis, a recommendation was made to bundle the purchase of Information Associate's On-Line Purchasing system along with other mainframe software. This proposal was approved in June, 1990 as the most cost-effective solution. An integrated Bids and Commodities module was included with the On-Line Purchasing software contract.

The original On-Line Purchasing software implementation plan was divided into three phases:

Phase	Activity	Target Date
1	Install base module for centralized use in Purchasing Department.	January, 1991
2	Decentralize purchasing module usage.	January, 1992
3	Implement Bids and Commodities modules.	1992

In August, 1991, the University decided to conduct the purchasing process review described on page 3 of this paper. The original implementation plan was placed on hold. The process review team recommended significant changes to the original software implementation plan. A new, five-phase implementation plan was developed in November, 1991:

Phase	Activity	Target Date
1	Install base module for centralized use in Purchasing Department.	July, 1992
2	Streamline and simplify screens.	December, 1992
3	Decentralize purchasing module usage.	June, 1993
4	Implement Bids and Commodities modules.	1993
5	Graphical Interface.	?

Phase 2 involves modifying a system that was designed to support a traditional purchasing department function to meet the requirements of the reengineered process. A new series of 14 screens was created using a vendor-supplied tool called Screen Builder. The original purchasing screens were used as a model for these new screens.

The goal of Phase 2 is to protect the underlying COBOL applications from modification as much as possible. Screen Builder is being used to make cosmetic changes to the screens. For example, one original screen contains 20 fields related to Receiving/Invoice data. Only 11 of these fields are relevant to end users entering routine receiver transactions. A total of nine fields has been deleted. When extensive modifications are required, the original program is copied to a new program name and the modifications are made. All changes are documented and kept with other system changes. To date, the programming and analysis effort to modify all 14 screens in our test system and eventually move them to production has amounted to 340 hours. Most of this time has been spent working with a group of five end users to identify, prototype, and test the screen changes.

Phase 3 covers the decentralized implementation of the modified system. Rather than typing purchase requisitions to submit to the Purchasing Department to process, using the On-Line Purchasing system, each department will be able to create purchase orders for amounts up to $3000. These purchase orders created will be printed nightly at a central location. Remote purchase order printing on demand is also being considered.

Phase 4, the installation of the Bids and Commodities modules, will occur concurrently with Phase 3. The primary benefit of this module will be to automate manual bid processing within the Purchasing Department.

Phase 5 represents the University's goal to deliver a purchasing system that is easy-to-use and is tailored to the users' needs while taking advantage of the computing resources available on users' desktops. This future system will have the following characteristics:

1. Data entry screens that look like the underlying document (e.g. a purchasing screen that looks like a purchase order).
2. Separation of the screen presentation software from the application software.
3. Simple ad hoc query capabilities.

Whether this future scenario involves a migration of FRS, On-Line Purchasing and other mainframe applications to new client/server applications from Systems and Computer Technology Corporation (SCT acquired Information Associates in 1992) remains to be seen. Several options for providing the needed services are available. Stand alone PC applications could be used to feed the mainframe system, networked PC's could feed the system with data from PC-based or Client/Server-based systems, or PC's could be given direct access to mainframe data using any of several database gateway solutions.

CONCLUSION

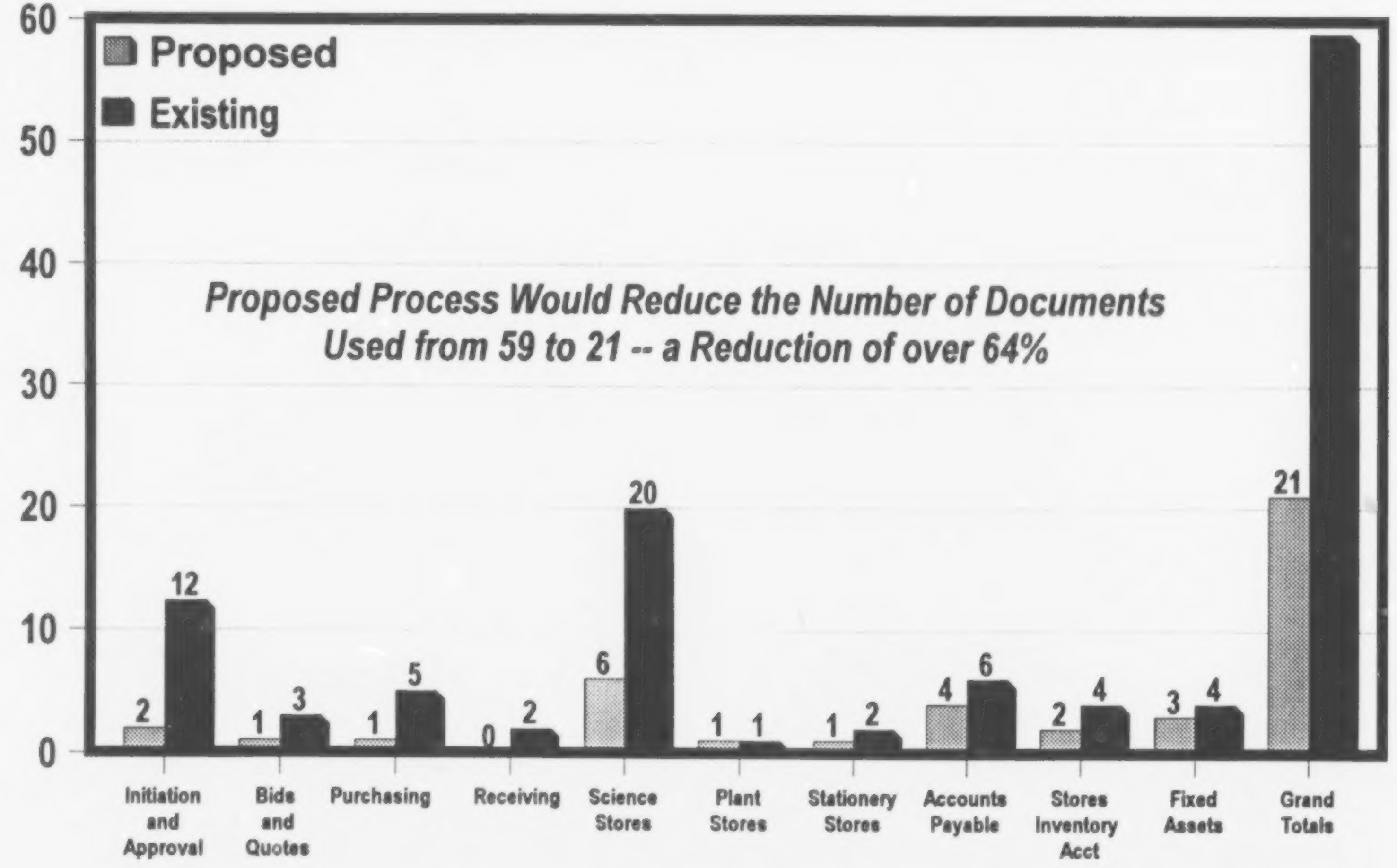
Ferris State University's administration is committed to the concept of continuous improvement of customer service. By instituting this cost and productivity study, the University has experienced significant improvements to a purchasing process that impacts all areas of the institution. To date, the University has realized operational savings of approximately $105,000 as a result of this effort. However, we recognize the need to continuously evaluate to determine what additional refinements might be made to further improve service.

Other areas are undergoing study. Accounting, Human Resources and Auxiliary operations are applying TQM concepts in their operations. We are confident that through commitment to improving processes and meeting customer needs, both the University and its customers will benefit in cost-efficiency and effective service.

FACTS ABOUT FERRIS STATE UNIVERSITY

Ferris State University is Michigan's premier polytechnic university, providing career-oriented education to 12,000 students through the Colleges of Allied Health Sciences, Arts and Sciences, Business, Education, Optometry, Pharmacy and Technology. More than 120 undergraduate programs, three masters programs and two doctoral programs are offered at Ferris State University's 600-acre campus in Big Rapids, Michigan, a city of 12,600 residents 50 miles north of Grand Rapids. A number of courses and programs are also offered at off-campus locations. Ferris serves the technological and work force demands of business and industry, the health care professions and society in general through applied research and practical education.

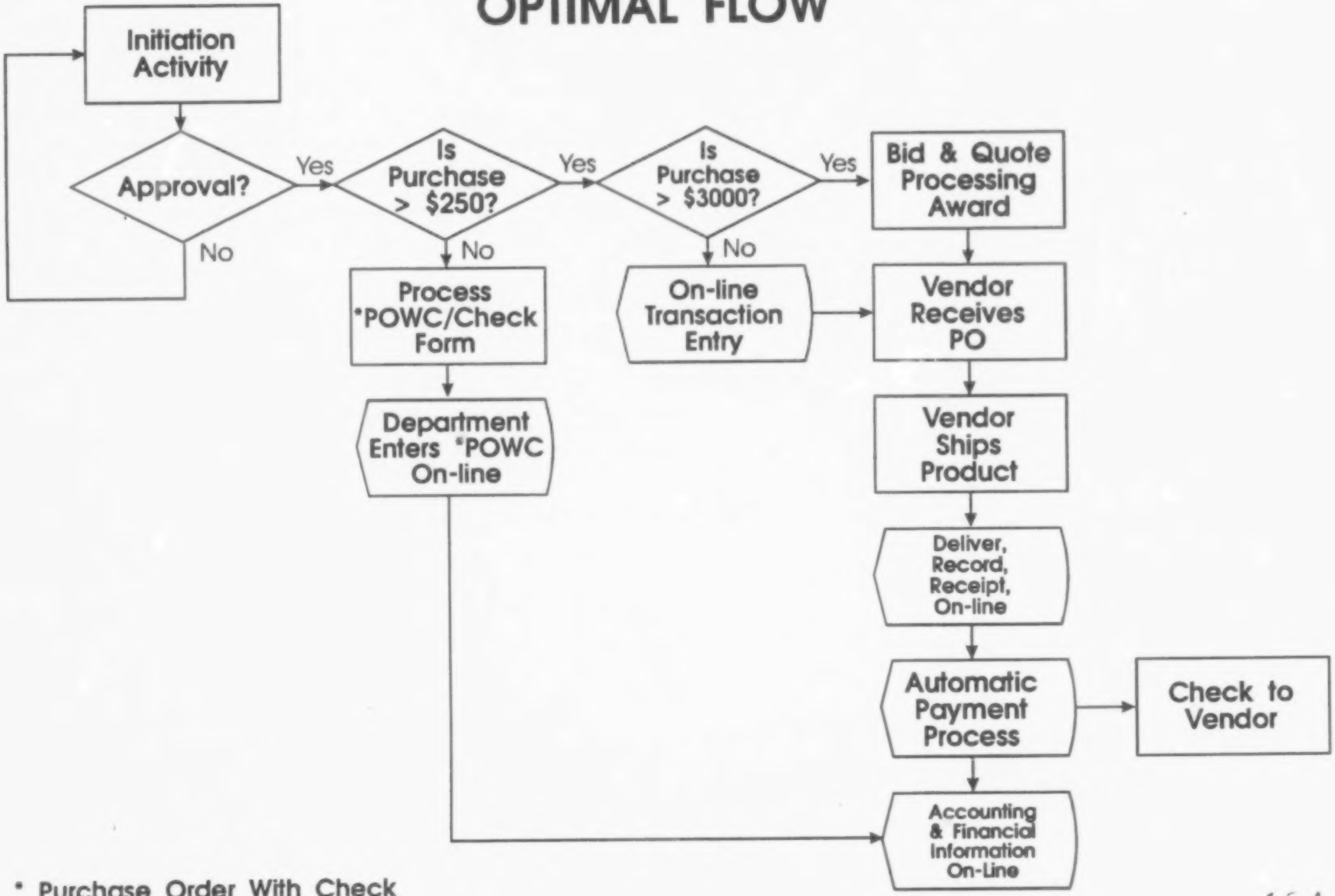
COMPARISON OF THE NUMBER OF DOCUMENTS USED



Proposed Process Would Reduce the Number of Documents Used from 59 to 21 -- a Reduction of over 64%

EXHIBIT A

PURCHASING PROCESS OPTIMAL FLOW



Initiation Activity

Approval?

Yes

No

Is Purchase > $250?

Yes

No

Process *POWC/Check Form

Department Enters *POWC On-line

Is Purchase > $3000?

Yes

No

On-line Transaction Entry

Bid & Quote Processing Award

Vendor Receives PO

Vendor Ships Product

Deliver, Record, Receipt, On-line

Automatic Payment Process

Check to Vendor

Accounting & Financial Information On-Line

* Purchase Order With Check

EXHIBIT B

Seminole ACCESS: A Multi-Function Campus Card System for the Information Age

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Abstract

The Seminole ACCESS card recently replaced the traditional photo-ID card for all faculty, staff and students. During the summer and first few weeks of the Fall term, over 30,000 cards were issued. This paper provides an overview of the characteristics, functions, and benefits of the Seminole ACCESS card system, with an emphasis on information processing requirements and opportunities. Topics such as system interfaces, cooperative processing, status verification, market research and digitized images will be addressed.

Seminole ACCESS: A Multi-Function Campus Card System for the Information Age

Introduction

In the Fall of 1992 Seminole ACCESS cards officially replaced the traditional photo-ID card for all faculty, staff and students. During the summer and first few weeks of the Fall term, over 30,000 cards were issued.

The Seminole ACCESS card provides the functionality of a traditional photo-id card, however, by adding a standard American Banking Association (ABA) magnetic stripe the potential uses of the card have increased substantially. Because FSU chose to take advantage of the banking industry's card processing systems and networks, the implications for information processing are considerable.

The typical campus card contains a photograph, affixed to a laminated card of some type, and a proprietary magnetic stripe for processing debit transactions at campus locations. With Seminole ACCESS, debit purchases can be made both on and off campus at over 300 locations. Moreover, the banking ATM network is available throughout Florida for students while traveling or on summer vacation. However, the ability to make purchases at off-campus merchants or withdraw funds from an ATM is only a part of the Seminole ACCESS story. The breadth of service offerings on campus and the card's ability to link the holder with administrative and academic information systems is the other part of the story.

The theme of this year's CAUSE conference, *Grasping the Momentum of the Information Age*, could not be more appropriate. Networks, open systems, imaging, multi-media, CASE and numerous other technologies are forcing us to change. Yet, some technologies, which have been around for years, still have considerable untapped potential. Such is the case for magnetic stripe technology. Much has been said and written about smart cards, but the cost of this technology has not yet dropped to the point where it is practical. Furthermore, the installed base of magnetic stripe technology is such that it will be years before the card industry implements smart card technology.

Magnetic stripe cards, though criticized for their limited capacity, lack of interchange at the track 2 level, and the security problems associated with their passivity, nevertheless have some major benefits, such as cost, unamortized investments in magnetic stripe technology, and effectiveness. At FSU we believe there is a significant role yet to be played by magnetic stripe technology in the information age. Further, we believe that when the time is right for the introduction of smart card applications, there will not be a better place for implementation than a university campus. Thus, while we are pushing magnetic stripe technology to its limits, we are positioning FSU to be the F*uture* S*mart card* U*niversity*.

But smart cards are another topic. The purpose of this paper is to examine the implications of the Seminole ACCESS card for information processing at FSU. The point has been made that the value of the card is that it contains an industry standard magnetic stripe. What makes this stripe so useful, however, is that an ABA ISO account number has been encoded onto the stripe. This 16-digit number is the key to off-campus, real-time, financial transaction processing, and is fast becoming the common key for accessing administrative data, as well as a variety of on-campus services.

System Interfaces

While a major benefit of the Seminole ACCESS card is that the debit-transaction processing component is a contracted service, in-house administrative computing staff had to build several interfaces to local systems.

One of the first information processing issues facing FSU involved providing pertinent faculty, staff and student data to the distributed computing systems that encode data on the Seminole ACCESS card. As a part of that process it was also necessary to develop a way to interface our host databases, which use the social security number as a key, with the Seminole ACCESS card which contains the debit account number. In developing the file to drive the card generation process it became clear that, if it was designed properly, it could also function as a crosswalk between account number and the social security number.

Our first notion that this file would contain little more than name, SSN, and account number was shortsighted. This single file, which moves in a cycle from the mainframe, to the card generation process, and back to the mainframe again, also gives us the ability, via a table lookup function, to access administrative applications knowing either the SSN or the account number. Because the use of student ID cards are so commonplace, almost all administrative systems must interface with this file.

The Seminole ACCESS file, or crossover file as it has come to be known, is originally constructed by combining data from a personnel/payroll database and a student database. After downloading to the microcomputer used to produce cards, it is updated with additional information related to the card holder. In the interim, the host files may have changed, so the crossover file must be uploaded to the host and refreshed. This admittedly cumbersome refresh cycle must be streamlined in the future. Ideally, this batch process will be replaced with an on-line, real-time process. Our limited experience with cooperative processing applications is clearly evident at this stage of the project.

Besides building the crossover file an interface had to be built for our on-line cashiering system to handle receipt of funds for deposit into Seminole ACCESS accounts. The cashiering system was modified to output these deposits to a file for transmission to the charge card center.

A third system interface involved adding the ACCESS address to our Centralized Address database. Some time ago we began removing redundant student address information from each of our on-line systems and centralizing this data in a single file that all on-line systems access. We decided to treat the ACCESS address as another possible address for a student and modified our Centralized Address database accordingly.

The Information Explosion

Having issued 30,000+ Seminole ACCESS cards allows us to process information in ways that were not possible before. This has resulted in a veritable explosion of information. When the former photo-ID card was being used, not much thought was given to the various categories of people on campus and who was eligible for which service. Basically, there were four types of people, full-time students, part-time students, non-paying students, and non-student, i.e., faculty or staff. Now that we have the ability to swipe a card and return information from a data base, the University can more specifically address the question of who is eligible for a particular service. In today's reality of shrinking budgets and increasing costs for services, it is important that we understand who is entitled to use services.

After studying this situation over 30 different categories of card-holders have been identified (see table 1). In determining how to effectively control access to services, the need arose for the development of a comprehensive system to recognize the status of an individual and determine, on the basis of predetermined criteria, eligibility for a particular service. This implies more changes to administrative applications that are used in the process of service delivery. One such system is our Health Center system. Not all card holders are eligible to receive services at the University Health Center. Accordingly, the application supporting the Center will be modified so that with the swipe of a card service eligibility can be determined.

Table 1. Sample Privileges by Category Matrix

Category	CARD	MCI	BANK	Parking	Health	Rec. Ctr.	Union
UnderG							
Part Time	X	X	X	X	X	?	X
Full Time	X	X	X	X	X	X	X
Grad							
Part Time	X	X	X	X	X	X	X
Full Time	X	X	X	X	X	X	X
Spouse					X	F	F

Scholars Pgm	X				F	
Faculty						
Part Time	X	X	X	X		F
Full Time	X	X	X	X		F
OPS	X	X	X	X		F
Staff						
Part Time	X	X	X	X		F
Full Time	X	X	X	X		F
OPS	X	X	X			F

Note: X=eligible F=eligible with fee ?=eligibility undecided blank=not eligible

At the present time we are deciding how best to implement an eligibility determination system based on a matrix of data similar to that shown in Table 1. A complicating factor is that not all service providers who want to make eligibility determinations use the University's host-based administrative applications. Our intent is to perform some eligibility processing on the microcomputer-based ACCESS security system that provides perimeter access support for a variety of buildings. However, what is required is a common application that exists in both the mainframe systems and in the distributed security system.

We are evaluating four basic options:

- Write batch programs within each subsystem (Cashiering, Health Center, Registration, etc.) to read the appropriate files and set flags on the crossover file. This places responsibility for eligibility determination with each subsystem and means substantial programming and crossover file updating. It also means an overnight delay in getting eligibility data downloaded to the ACCESS system file.

- Change each subsystem to update the crossover file on-line/real-time. This approach has the advantage of more current data, but all files aren't updated on-line and there would still need to be batch updates in many cases.

- Develop a single batch update program to make all eligibility determinations and update the crossover file. This has the advantage of putting all eligibility determination logic in one program and reduces maintenance.

- Determine eligibility real-time from an examination of the appropriate files. This puts the burden on each subsystem and doesn't address issues in which no data exists to determine eligibility. However, this approach does reduce work load and simplifies maintenance.

Regardless of the approach selected, one can see that a major issue we are working through is how to get mainframe systems and departmental systems to work in concert with one another. Using our current technology, this is cumbersome at best. At FSU we are convinced that if progress is to be made in cooperative processing, some new (to FSU) technology needs to be implemented.

In any event, the point is that through the use of the Seminole ACCESS card, information that was never accessible in a real-time fashion, can be made an integral part of our information processing environment. We will, in time, overcome the obstacles we have encountered in making these various systems work with each other.

Information Age Market Research

There is another dimension to the notion of defining carefully what categories of people the university serve and who is eligible for services. That is, determining who is actually using or paying for certain services. In order to know more about which categories of people use a facility, the debit account number must be matched against the crossover file containing the status of card holders and the services they are eligible to use. Potential use of this data for market research is considerable. Study after study can be done using data collected as people use facilities or buy drinks from vending machines. The Seminole ACCESS system can provide data on the number of women who use the recreation center, or how may freshmen attended a function sponsored by student government.

Table 2 presents some data that was collected recently at our new recreation center by swiping Seminole ACCESS cards on a hand held computer.

Table 2. FSU Recreational Center Usage

Men	Fresh	Soph	Junior	Senior	Grad
Caucasian	75	89	142	189	56
Afro-Amer	15	34	52	47	5
Hispanic	2	4	1	0	0
Women					
Caucasian	43	62	186	252	23
Afro-Amer	7	13	32	47	5
Hispanic	5	7	10	3	0

Obtaining such information is important and it can now be provided without filling out forms. Issues related to data collection are, for the most part, eliminated, as students do not mind swiping their Seminole ACCESS card through a hand-held reader. No doubt some of this data will be very valuable to vendors who sell products and services to members of the University community.

There is an entire body of market research data waiting to be tapped through the use of the Seminole ACCESS card.

Financial Processing

Students, faculty and staff use the Seminole ACCESS card to purchase everything from wash cycles in dormitory laundry machines to buying groceries at a PUBLIX supermarket while on vacation in Miami. Each transaction creates information that was not available previously. For example, when matched with University data files to extract impersonal, demographic data, extensive market research can by done on buying habits.

Digitized Images

FSU is using a system to produce ACCESS cards that captures and stores a digitized image of the cardholder. This feature opens new information processing opportunities that extend beyond the ACCESS card.

A disadvantage of working with digitized images is the amount of storage required and the bandwidth required to move such images across a network. An uncompressed digitized photograph for an ID card would require between 60,000 and 80,000 bytes of storage. New techniques, however, are available to reduce this storage requirement to about 3,000 bytes per image.

FSU now has a digitized image of every person issued a Seminole ACCESS card, and is planning to use this data in a variety of ways. Some of the possibilities include:

- distributing the image file to individual departments to be used in local systems such as Campus Security.
- supplementing the identification procedure at the University's standardized testing center to include visual verification by an operator at a PC.
- adding a student's photo to class rosters distributed to faculty.

Self-Inquiry

Providing distributed access to administrative data via specialized terminal kiosks is a common practice on many college campuses. FSU has been using "self-inquiry" terminals for several years to provide students with information on their class schedule and fees owed. As FSU expands use of this system, by adding new functions, such as printing transcripts, and by using more advanced ATM-like terminals, provision will be made for making the ACCESS card the activation mechanism of choice.

Conclusion

Seminole ACCESS is a practical system that provides a single-card for use in multiple ways both on an off the college campus. It is seen as a key that unlocks the services of many varied, independently functioning applications of both a financial and administrative nature. The ability to pull information collected from all of these types of applications and begin to analyze the data to determine future needs and uses is a major benefit of the Seminole ACCESS architecture.

The data collected today can be used to support the planning of future services for our students, faculty and staff. The information age demands information. The Seminole ACCESS system provides a new way to transform data into information, and at FSU we are very much aware of the momentum generated by that process. The goal is to grasp that momentum and be carried into to a more productive and prosperous future.

Doing More With Less
or
Why Change if the Applications Work

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ABSTRACT

While the impact of the economic downturn and unfavorable demographics has hit institutions of higher education, the effect has been compounded on the University of Hartford because it is an independent university with a modest endowment. In this environment, many operations of the University were reviewed with the goal of "Doing More With Less," including the highly successful portfolio of the University's administrative systems.

Since information technology has rapidly advanced since these applications were designed, it was concluded that there was a "window of opportunity" to reduce costs by moving to a new set of applications based on newer technology. In addition, administrative applications systems would be strategically positioned for future.

Essential to this project are the goals of and support by senior level management and the high level of experience, expertise, and commitment of end user and CS staffs.

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Doing More With Less or Why Change if the Applications Work

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PROJECT COMMENCEMENT MEETING

All the project team members of University were invited to the official "kick-off" meeting of the project to change the entire administrative applications. The implementation team members number over 50 and come from a wide range of University departments. At this meeting the University president and senior administrators congratulated all of the new team members and emphasize the significance of this project to University. This conversion project was termed as being absolutely vital to the University and as playing an important role in working smarter and faster.

Why the University decided to change from administrative information systems that were working well and how the project started and is progressing is the subject of this paper.

UNIVERSITY OF HARTFORD - "TUITION DRIVEN"

To understand the forces behind the project to change administrative systems that working very well, the current economic circumstances of the University of Hartford must be related to the poor economic and demographic conditions of the recent past. Located on a 300 acre campus in the greater Hartford area, the University is an independent, comprehensive university. With a modest endowment portfolio and other few sources of significant funds, the University's economic dependency has been aptly described as "tuition driven." The impact of fewer students also decreases of revenues from other sources, such as residential housing.

Most of the more than 3,800 full-time undergraduate students and 4,000 others come from the northeastern part of the United States, which has been economically depressed for a number of years. Furthermore, the University competes to some extent with the less expensive state institutions in its region of the country. The situation is further compounded by the general decline in the pool of appropriate high school graduates in the University's historic recruiting area. Understandably, there is increased competition for students, which has prompted additional resources to be committed to recruitment and to enhancing academic programs. As the economic situation has squeezed available resources, the internal competition for funding of valuable programs forced a rigorous review of doing more with fewer resources.

DOING MORE WITH LESS - AN INSTITUTIONAL URGENCY

When the impact of the declining number of students was felt by the University, an exhaustive review of operations was initiated that resulted in a series of difficult budgetary reductions. In the fall of 1991, budgetary reductions were made in many areas including personnel costs. While programs such as early retirements and 10 month staff positions reduced personnel costs, some layoffs also occurred.

It was hoped that these actions would be sufficient. However, as the forecast for the next academic year became clear in the spring of 1992, further actions were required. Once again the budget cuts included personnel reductions and elimination of some projects designed to enhance the University's attractiveness to prospective students.

DOING MORE WITH LESS - CS DEPARTMENT

The Computer Services department (CS) was not spared the impact of the two general budgetary reductions and lost over 20% of its personnel. The strategic alternatives for administrative systems had been under continual review by CS within the framework of reducing costs while maintaining the current level of support for administrative information systems. A strategic plan outline had been created and, where possible, the reductions were made in groups that would need fewer personnel in the projected administrative system environment of the future.

With the instructions to do more with less, CS began a new comprehensive review. Due to its on-going planning activity, the principal considerations and primary alternatives[1] for the future were well understood. The conclusions from the review can be summarized into three points, which are discussed in more detail in following paragraphs.

1. The current administrative information systems are very successful and integral to the administrative operation of the University.
2. But, these systems were designed a decade ago with the information technologies that were available at that time and there were major concerns about the future of the current applications.
3. Hence, the dramatic changes in information technology and the University's information technology infra-structure provide an opportunity to reduce costs while positioning the administrative systems for the future.

1. Current Application Systems - Successful and Essential

Over the past decade, the University of Hartford has invested in a comprehensive portfolio of integrated administrative information systems. Although the application software had been acquired from a major software vendor, Systems and Computer Technology (SCT), the software had been substantially modified and enhanced to satisfy the specific needs of the University. The applications systems are the alumni and donor development system (ADDS), the student accounts receivable (ARIS, which is integrated with ISIS), the human resource and payroll system (HRIS), the financial information system (IFIS), and the student information system (ISIS). The ISIS system is by far the largest of all the systems and incorporates most of the University's modifications and enhancements. The present portfolio of administrative information systems have been integrated into the daily operations of the University. A few quantifiable measures are displayed below to indicate the size of the administrative systems as well the support needed to maintain the current systems by the present staff of seven CS application professionals.

Current Administrative Application Systems

Item	Number
Source Code Modules	3,040
On-line Screens	477
Data Base Records	15.4 million

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[1] Vendor products and services are discussed only in the context of the University's environment, experience, and plans rather than any endorsement or criticism of any specific vendor product or service.

Another important factor in the usage growth has been the expansion of the information technology infrastructure that now includes a campus-wide data communications network. The number of users with privilege to access the on-line production administrative systems has more than doubled during the past few years to over 500.

2. Current Application Systems - Old Design; Future Path?

The administrative applications were originally designed by SCT with the pervasive information technology of that time. While the University's applications had been modified, new enhancements made, and new modules added, the underlying technology is basically from the same era. The current status can be characterized as systems designed with older information technology using a proprietary platform. It is the cost of this proprietary platform that attracted the most scrutiny in the new review to reduce costs.

Current Administrative Systems

• Applications	• Modified and enhanced vendor application software (SCT Symmetry series) written in COBOL.
• Environment	• IBM 4381 with MVS/XA and CICS, CINCOM's RDBMS Supra 1.3.5 (non-SQL)

The on-going strategic review process in CS had identified the long-term information technology objectives that would protect and enhance the University's investment in their administrative systems. It was also realized that the process would require intermediate steps that would allow the University to eventually achieve the longer term objectives in a judicious plan that also recognized the other competing demands that must be satisfied in the short term.

Administrative Systems - Long Term Objectives

- Achieve flexibility in selecting future computer platforms.
- Improve ease of use and training of application end users.
- Operate with a relational database management system that has SQL functionality.
- Increase end user access to information, including English language query capability.
- Position systems to exploit emerging and future information technologies (e.g., client/server, automated work flow, imaging systems).
- Acquire and employ more productive application development and maintenance tools.

In light of the long term objectives, the important aspects of the current situation were reviewed while considering the following constraints.

Administrative Systems - Planning Constraints

- CS staff is to remain few in number.
- Any new system must provide the essential functionality that is currently provided.
- Existing applications are to remain fully operational during all changes or transitions to new products.
- Alternative computer platforms must be robust, mature and from a leading vendor.

As the principal alternatives to the current environment were assessed in the context of the above objects and constraints, three general strategic directions were identified.

Administrative Systems - Future Directions

- Continue with the current applications and compatible platforms,
- Move to other platforms with the same applications, and
- Move to different applications on a different platform.

• Continue with the current applications and compatible platforms
As the usage demands continued to grow, staying with the first alternative meant that the current platform would need to go through an expensive upgrade and after the upgrade the same issues about the future would remain. The real opportunity would be to move to different, less expensive platforms with the same or different applications.

• Move to different platforms with the same applications
One of the prime concerns with the existing application software was that the vendor (SCT) had developed a very successful new product line (BANNER) that had over shadowed the older product line (Symmetry). This created the predicament in which clients with the old product line decided to drop the enhancement and maintenance program because of an expectation of reduced support from the vendor and the vendor having to reducing support because of fewer clients subscribing to the enhancement and maintenance program. For the University, this trend meant that increasing resources (staff and computer systems) would be needed to achieve the same level of application system support in the future. In addition, the eventual phasing out of this old product line by the vendor was anticipated. Staying with the current applications but on a different, less expensive platform would not address these issues.

Another information technology concern was the lack of SQL capabilities with the current RDBMS (Supra version 1.3.5). Since the logical upgrade from Supra 1.3.5 is Supra 2.X (which has SQL), the upgrade effort and requirements have been monitored and under consideration for some time. Based on our situation, our analysis determined that moving from Supra 1.3.5 to Supra 2.X would be much more than just a version change but a major undertaking for the University. It was concluded that just going to Supra 2.X would not yield sufficient benefits to justify the effort and that achieving SQL capability should be a component of a larger project rather than an isolated effort.

• Move to a different platform with different applications
The alternative of moving to other platforms with different applications raised the issue of outsourcing application development. Considering the extent and use of the current applications as well as the above constraints that included keeping the professional staff small in number, it was concluded that any future administrative systems would be appropriate vendor software with the necessary modifications and enhancements. The use of vendor application software is, in effect, "outsourcing" a large part of the development effort, while continuing the enhancement and maintenance program with the vendor is an "outsourcing" of some of the on-going systems analyst and programming work. Another consideration for vendor application software was that it must be successful in the higher educational market place and that, preferably, one vendor could supply all applications. The latter consideration would provide a consistency across systems for users and allow for more efficient support of systems with a small CS staff. The leading candidate was the new, successful application series (BANNER) from the current software vendor, SCT.

The obvious hardware alternatives for the University were UNIX systems and/or DEC VAX platforms. DEC was a major consideration because of DEC's strategic direction toward openness, the University's experience with DEC platforms, and DEC's program of the free licensing of its software products, including systems software, to higher educational institutions. Since the University had a DEC VAX system for academic use since the late 1970s, it had taken advantage of this program as it upgraded its academic computer system, installed new computer equipment for a library system, and installed its campus data network. Thus, the University has a high level of experience and expertise with DEC equipment and software with a very small staff. The DEC platform is robust and mature and DEC is a leading computer vendor. Given the University's circumstances, the DEC platform emerged as the prime candidate for a move to a different platform for administrative applications.

3. Opportunity for Doing More With Less While Achieving Strategic Objectives

As indicated above, the implications for the major information technology alternatives for University were well understood. With the directive of "Doing More With Less," starting on the path to the future became an immediate opportunity. Plans were developed to move to the new systems both quickly and prudently while maintaining the old systems.

Administrative Systems - Future Production Status

• Applications	• Modified vendor application software (SCT BANNER series) • Increased ease of use and user access to information - report writers, English language query product
• Environment	• DEC 6620 with VMS; Oracle RDBMS 6.0; Oracle SQL*Forms & SQL*Menu

The feasibility of the project was carefully examined as to achieving the objectives within a reasonable time frame, since the immediate reason for the project was not achieving information technology objectives but reducing costs as soon as possible.

Accessing the Feasibility of and Creating a Project Plan - Major Factors

- Senior staff support.
    - End of changes to current applications except for regulatory or University requirements.
    - Commitment of user departments and the time of user team members.
- Expertise of the application users and CS development staff.
    - Accelerated training and consulting.
    - Use of temporary, contract personnel.
- Same vendor for both application software series.
    - Logical progression of core functional design from the old to the new applications.
    - Fast "maturing" of functionality of the new applications versus the mature functionality in the University's current production systems.
    - Consultants with knowledge of old and new applications.
- "Freezing" of systems on the old computer platform.
    - No changes on the operating system, equipment, etc. on the IBM platform.
    - Accomplish transition to the new systems before an upgrade of the old platform is needed.

Accessing the Feasibility of and Creating a Project Plan - Major Factors (Concluded)

- Replacement of equipment to allow access to the new system
  - Network infrastructure in place except for near-by buildings.

The feasibility of the project depended upon a "window of opportunity" in which the transition to the new systems could be completed before an upgrade to the old computer platform would be needed. The systems analysts and key users reviewed the new and the old systems and created an outline plan and production dates for each of the major application products. Other institutions were contacted and visited to discuss their experience with the BANNER products and their conversion projects.

For each of the major application products, a general outline of the categories of plan activities was followed by key users and CS systems analysts.

Conversion Plan - Task Categories

- Training/Consulting - Functional and Technical
  - Accelerated for those experienced in current applications
  - Audience: Implementation team members
- Data conversion
  - Data element analysis and conversion programs
- Validation tables and rules creation for new applications
- Modifications to baseline
  - Changes to data base, forms, and programs
  - New forms and programs
- Interfaces
  - During transition (between applications in the old and new systems)
  - After transition (between the applications in the new system)
- Departmental Training
  - Creation of training for the production system
  - Training to occur just before the move to production
- User Access to Information
  - Selection, installation, and training - report writers, text processors, and other query tools
  - Selection, installation, and training - English language query products
- Internal CS Management, Control, and Procedures
  - Change management, scheduling software, backup/recovery, security, etc.
  - Productivity tools and products for systems analysts and programmers

The result of this analysis was a plan with the target production dates for the various products that took into consideration the work needed to be done in the Task Categories and the user departments estimate of the best time of year for them to change over to the new system. Since the English language query facility would not be useful until sufficient data was converted to one of the new application products, selection of this product was scheduled to begin in the first quarter of 1993.

Conversion Project - Dates of Major Events

DEC 6610 system	June 1992 (Completed)
Oracle products, Baseline applications	July 1992 (Completed)
BANNER Finance	December 1993
BANNER Human Resources	January 1994
BANNER Alumni/Development	May 1994
BANNER Student, Financial Aid	August 1994

Necessarily, the review was based on assumptions about converting to a "moving target," since the very successful BANNER series was maturing with a series of updates from SCT. The actual release of the BANNER products that would be used for production would be decided after the project began and would be based on a more detailed implementation plan and the vendor's release schedule.

Considering the time frame and cost for the implementation of the project, the financial analysis resulted in an estimated savings of over $400,000 per year. Naturally, it was based on a number of factors subject to change, but there was confidence that this figure will be attained.

REVIEWS AND APPROVALS

With a project this size, it not unexpected that there was an extensive review and approval route. Revisions and improvements were made at each step along the way. Starting with the internal reviews with CS personnel and key users, the process was to involve the entire user community at some point in the process. As an independent check, external consultants went over the plans and made recommendations. Senior staff reviewed and finally approved the project for presentation to the Board of Regents, which made the final approval.

Major Reviews and Approvals

- Internal CS reviews with key users and contacts with other BANNER clients
- General presentations and review by the user community
- Senior Staff reviews
- External consultant review
- Senior Staff approvals
- Approval by the Board of Regents

IMPLEMENTATION

The approval of the project was given by the Board of Regents in May 1992 and the official start of the project began with the new fiscal year on July 1. The training of the Computer Services staff began at the end of May when the data base administrator (DBA) started DBA Oracle training sessions in order to be ready for the installation of Oracle and BANNER products in early July. Computer Services personnel initially trained in DEC VMS and Oracle RDBMS and SQL, using computer based training (CBT) or self-paced instruction, and Oracle developmental products.

The project organization was designed to be user-driven with a predominance of users on all of the project teams. There are "link pins" (common members) between teams to share information and project news.

BANNER Project Management Organization

Project Advisor Board (7 members)
Communication Team (3 members)
Implementation teams (Average 19 members):

Project Team	BANNER Products
Alumni Development Team	Alumni/Development
Finance & Human Resource Team	Finance, Human Resource
Student & Financial Aid Team	Student, Financial Aid

The Project Advisory Board is composed of senior administrators and functions as the University's overseer for the project and resolves cross BANNER product issues as necessary. The Communication Team is to inform the University community of the progress of the project. The implementation project teams were organized to include key user, application end users from various departments, and CS system analysts. Since the software products are composed of a number of modules designed for particular departmental functions, a variety of representative end users were included in each team to ensure an institution-wide involvement in the implementation. The teams are each led by an experienced user and were grouped by related BANNER products. It was expected that sub-teams will be formed to handle specific products as appropriate.

Training is a very important part of the project. The earliest training was to prepare the information systems professionals for the new technology. The next block of "training" was to both train and provide consulting to the members of the project teams as they began the project tasks, which includes the creation of a detailed project plan (e.g., data conversion, modifications, new programs, and training,). Soon after the installation of the baseline application systems on the University's new DEC system, the training by the application vendor consultants began. Training was divided into a series of sessions by application and type (which is either functional training for users or technical training for information system professionals). Over 25 weeks of on-site training/consulting was scheduled. The production training of the departmental end users will occur just before the move to production and will be based on the actual production system with the University's validation tables, rules, changes, enhancements, etc.

EVALUATION OF THE CURRENT STATUS

As of this writing, there have not been any surprises that would imperil its success or hasten its completion. However, there have been some notable events and experience worth noting.

On-Site Functional Training/Consulting Sessions

The extent of on-site functional training was expanded beyond what was originally planned. Scheduling of the larger implementation teams was a major problem, even though most team members attended training only for those application modules that directly concern their departments. Changes in the implementation dates also prompted an accelerated schedule for some systems. However, the faster-paced on-site training with correlations to the old applications is considered the better alternative for the team members than the lengthier standard training in the baseline product.

Most of the trainers/consultants from SCT were knowledgeable in both the old Symmetry and the new BANNER systems. Drawing upon this experience is a major benefit to the project.

Unexpected Loss of Personnel

Key University personnel were lost for a variety of reasons including unexpected early retirements and new jobs at other institutions. The result has been a delay in some areas, which is expected to be made up over the life of the project. However, loss of personnel who have experience with the old systems is a definite problem.

There has been another temporary loss of a key vendor consultant due to a major medical problem. This misfortune is not expected to significantly delay progress of the project.

Changes in Project Organization

Two changes occurred for different reasons. The first was a general perception from the implementation team members that a new committee should be formed to address the common data issues. This new Common Data committee has the goal of investigating issues surrounding the common data and validation tables in the new BANNER products and making recommendations to the Project Advisory Board. As with all other implementation teams, the leader is a knowledgeable user and the members come from other teams to ensure dynamic interaction and sharing of information among the teams. One of the hardest issues is determining a procedure of updating common data in a controlled, rational approach that is acceptable to all involved departments.

The other organizational change was the splitting of the Finance and Human Resources team into two teams with a new leader for the Human Resources team. This change was prompted by the loss of a senior person in the financial affairs area and the additional workload that the leader of the old combined team had to assume.

BANNER Project Management Organization (Revised)

- Project Advisor Board
  - Communication Team
  - Common Data Team
  - Alumni Development Team (BANNER Alumni/Development)
  - Finance Team (BANNER Finance)
  - Human Resource Team (BANNER Human Resource)
  - Student & Financial Aid Team (BANNER Student, Financial Aid)

Implementation Dates - Changes

The most significant change in the implementation dates was for Finance, which is now scheduled five months earlier to coincide with the beginning of the new fiscal year. This earlier implementation date will result in not having to convert certain detail financial records of the current fiscal year to the new system.

Plan for Production Status by BANNER Product (Revised)

Finance	July 1993
Alumni/Development	February 1994
Human Resources	March 1994
Student & Financial Aid	August 1994

Unexpected Demands for Recruitment, etc.
Recruitment and retention activities and other support demands have been much higher than expected and has, consequently, drawn both user and CS resources away from the project. The impact of these activities has been mainly felt in the Student and Financial Aid project.

Production - BANNER Version
As discussed above, SCT has constantly been enhancing and expanding the application products. At some point, a BANNER release had to be picked that would be the basis for the production systems at the University. SCT has announced that the first quarter 1993 release will be a "very clean" release that will resolve all problems as of October 1992. This release will also be the basis of the next major technical upgrade of BANNER (named BANNER2). It is now planned that this is the release that will be the basis of the new production systems.

CBT Training for CS Personnel
In general, the approach was successful because of its flexibility to each person's schedule. However for those assigned to applications that demanded critical, additional support, the progress was slower than planned. As is well known, off-site training usually provides better conditions to concentrate on the learning the material.

SUMMARY - WHY CHANGE?

The question of "Why Change" can be briefly stated. The circumstances of the University and the alternates available to it created a "window of opportunity" to reduce costs while positioning the administrative applications for the future. While the existing systems could have been continued for a number of years, it would have been increasingly expensive and would have left the University with older systems on a proprietary platform. Furthermore, these older systems would continue to face an uncertain future. After considering the alternatives and issues, the prudent decision was made to change applications that work before the window of opportunity closed.

Utopia vs. Mundania: Coping Strategies for Living with Shrinking Resources in the Real World

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In the Utopian world, the challenge of shrinking resources is met with people working harder and smarter. Increasing productivity is a necessary goal of the times we live in, but there are limits to that framework. This paper explores these limits, noting especially suggestions for practical increases in productivity open to almost everyone. Moreover, in Mundania, the world in which we live, information technology activities are open to sniping in these times, when all of higher education feels threatened. Careful and accurate communication may help reduce the lack of institutional support that this sniping could encourage. Additionally, managers also have a responsibility to preserve organizational health. The greatest danger of shrinking resources is that the organization could be critically damaged. Organizations must preserve their capacity to recover to a necessary position of technical capability when times do get better.

Utopia vs. Mundania: Coping Strategies for Living with Shrinking Resources in the Real World

". . [A]ll things begin by little and little to wax pleasant: the air soft, temperate, and gentle; the ground covered with green grass; less wildness in the beasts." Sir Thomas More, Utopia.

"There's no magic in Mundania." Piers Anthony, Man From Mundania.

Utopia is a land where simple solutions produce elegant results. It is a land where people read sales brochures that promise productivity increases--and they believe the brochures. It is a land where salespersons can make extravagant claims for saving money while heightening capability--without fear of contradiction. It is a land, in brief, where expectations are never disappointed. To be practical instead of mythical: Utopia is a situation in which information systems deliver all their promises, including the reduction of costs and the satisfaction of every need. Executive management in many enterprises holds the wistful view that Utopia has arrived in the Information Technology area. In fact, there is a sizable body of managers that buys a set of unfortunately simplistic aphorisms whose basic premises are unrealistic:

--an organization's productivity can be increased by working harder.

--when the going gets tough, the tough get going.

--deadlines are always to be met, no matter the circumstances.

--an organization's productivity can be increased by working *smarter*.

Unfortunately, we don't live in Utopia; we live in Mundania. In Mundania, there are no magic solutions, no cure-alls, no quick keys to success. In Mundania, there is little appreciation for the costs of technology, either in time or dollars. And resources to accomplish anything are shrinking. Ironically, shrinking resources means that not only does information technology bear the burden of helping organizations meet increasing demands, but it must do so with shrinking resources itself. Furthermore, information technology gains little sympathy for its intrinsic complexity. While executive management aphorisms may be excessively cheerful, those people in the trenches of the fight quote vaguely cynical phrases to one another:

--There is always time to fix the problem, but never enough time to do it right.

--The cobbler's children never have new shoes.
--If anything can go wrong, it will.

--Double the estimate.

But there is no abiding need to tail off into permanent disquiet over this state of affairs. Utopia never will come, fond hopes to the contrary. But there can be success stories coming from Mundania. This paper concentrates on elaborating a few successful coping strategies available to any information technology organization in recent times.

Increasing Productivity

Several practical strategies are available to aid personnel productivity. In the case of programmers, the field is rife: fourth-generation languages now have sufficient maturity to be used effectively. As programmer assist tools they may enhance productivity as much as on-line programming tools like TSO did 15 years ago. Some organizations are showing productivity improvements even beyond the salespersons' claims of trebling output over a fixed length of time. 4GLs may have considerable deficiencies when it comes to non-programmer use, but programmers definitely benefit. Some report writing tools fall in the same category of productivity enhancers, especially when training time is reduced as those tools have become more user-friendly. (And does it matter whose productivity is increased? Not at all, if effective reports and data are in the hands of the right people in a timely way.) Other types of programmer skill-enhancing tools include screen-painting software for teleprocessing, cross-reference tools for data debugging, and PC-based language tools. The latter can allow programmers who are used to mainframe-based coding and debugging to write production programs on their PCs for later transfer to the mainframe. In today's environment, the savings come in two ways: more effective use of desktop computing power, and the reduction of use of costly teleprocessing and mainframe components during business hours.

There really are many wonderful strategies for increasing programmer productivity. Most have achieved at least part of their promise. But while an individual programmer can generally be at least a magnitude more productive than his or her counterpart of twenty years ago, what about the put-upon analyst? Because of a much closer attention to analytic tasks over this same twenty-year period, analysis is actually *less* productive. The business of taking vague desires and turning them into a set of rigorous requirements is intrinsically difficult. Translating the needs of users into some formula capable of satisfaction by technology has never been easy, nor is it a job for amateurs. The industry response has been to tout the benefits of the Computer-Assisted Systems Environment (CASE). While many of us would like to find a magic bullet to end the frustration that seems to accompany all analysis, whether CASE is Utopian or suitable for Mundania has yet to be determined. While CASE tools are reportedly used by about 1/3 of all MIS sites, one survey indicates a market penetration of only 15% in Education sites.

Auditors (and many managers) now expect a systems development methodology (SDM) to govern the entire process of systems development and maintenance. Whether it is home-grown or purchased, an SDM is now fashionable. But it is more than that; it should be a productivity enhancer. How is that possible, when an SDM requires an organization to document and approve many things that were taken for granted in the past? An SDM actually does two things; first, it places development on a contractual basis, formalizing agreements. Secondly, it places development in an engineering context, in which activity occurs in a linear fashion; from incomplete understanding, to requirements definition, to product. At each step along the way, specificity is increased. The gain in productivity occurs because there is far less risk of a system solving the wrong problem. The implicit rigor forces users to be clear about their needs and makes analysts and programmers deal with the actual problems, rather than some perceived problems. Time and money is not wasted on hardware and software that is "neat" but does not substantively and favorably change methods of operation. A good systems analyst may do all these things instinctively, of course; an SDM turns even inexperienced analysts into change agents for increased productivity.

Training is also a key to increased productivity. Too often, in times of financial stress, training moneys are difficult to come by. It should not be so, because training has enormous leverage. Staff development is the key to any future of greater fulfillment of institutional need. As a famous billionaire said, "developing people exceeds the value of capital expenditures ten times out of ten." People become ultimately more productive when they learn of new tools and methods and want to use them. As Seymour Papert was fond of noting, "if the only tool you have is a hammer, everything looks like a nail." Crude tools result in crude products.

But productivity is increased in the long run by spending money in the short run. How is this possible, in the era of shrinking resources? One of the key phrases the manager must learn to use is "investment for the future." Almost everyone understands that grim times require grim cost-cutting. The important point is to continue to insist that all the productivity enhancements that have a sure payoff (software for programmer productivity, a systems development methodology, staff development) are seen as the foundation for a better situation when resources are in better supply. Every institution understands the need to invest in the future.

Hardware Cost Advantages

Perhaps the best way of making significant change in information technology cost parameters is in the area of hardware. Opportunities need to be explored that may have been ignored in the past. One such is the used equipment market. That market is well-defined, extremely competitive, and ripe for bargain hunting. In the mainframe CPU arena, some institutions have reduced their annual investment-amortized expenditure for CPU support to 20% of former costs by using the technique of buying on the used market.

Certainly, there are some cost increases in terms of space, environmentals, and maintenance, but the net result is still a substantial reduction in costs. Similar results are possible with terminals and mainframe disks. Most authorities will caution against purchasing such items as printers or tape transports on the used market, but ordinarily any cost analysis that considers the cost of maintenance will see that cost factored in. Maintenance companies are not in the business of losing money, and if boxes cost a lot to maintain, the customer will pay that cost.

Another technique used very successfully by many companies in these times is "down-sizing." In this context, the term is meant to refer to taking applications that are on a presumably expensive mainframe and moving them to a smaller platform. There is some controversy about this approach, as there is with any discussion of economy of scale, but there are areas where it is apt. Almost no one advocates using a mainframe word processing system, for instance. Down-sizing also can mean that users have data on their own PCs for use for reports and studies. Additionally, downsizing can mean that applications themselves that previously might have just been on a mainframe can be placed on a departmental stand-alone machine or on a local area network. Down-sizing has the potential of reducing mainframe costs, both in hardware and in technical personnel.

Institutions need to keep below the technology wave crest. By that it is meant that the high cost of new technology should be avoided. We see this in our home lives: the first people on the block to buy VCRs ended up with klunky, unreliable, and feature-poor machines that they threw away because it was too expensive to repair them. There are business analogues. Pioneers, it is said, can be recognized by the arrows in their backs. There is always plenty of time to find out if a technology is going to be a mainstream technology before committing resources to it. A current example is optical disk technology: it is very attractive to people who have substantial hard copy records. But it is also very expensive and very inconvenient to use with many records repositories. Perhaps that situation will change--as it seems to be changing now with CD-ROM in the instructional area, where suddenly the critical mass of customers has reached the point where software can be sold for almost a reasonable price.

A few other techniques for reducing hardware costs can be mentioned in passing. Although it is hard to endorse these for every situation, even a casual survey of options needs to look at the following:

1) Insurance for maintenance costs. There are companies that will insure the organization against excessive costs under a time-and-materials maintenance arrangement.

2) Plug-Compatible Machinery. From mainframes to PCs, there are bargains available by purchasing equipment that does not have a common household name.

3) Third-Party Maintenance. Companies are very willing to come in and maintain equipment that they did not manufacture, usually at low cost.

One point often forgotten is that, for every dollar saved by any of these techniques, there is some displaced cost elsewhere. For example, a maintenance insurance contract requires constant supervision and there is a lot of paperwork.

Communication and Connection

The context of the times needs to be considered. Everyone, in all academic settings, is feeling the pinch of economic constriction nowadays. A key for the information technology manager is to understand that the IT situation is not unique within the institution. Hence any campaign for support needs to be in concert with the belt-tightening going on all around. Stridency does have its merits. But the IT manager should actively seek support from other areas to actually start the kind of change that either cuts costs at the expense of service understandings or raises costs in order to provide better service in the future.

Communication is the key. Other areas within the institution need to be informed about what is being done, so that the IT area can be seen as part of the common solution to institutional problems. If communication is not effective and constant, there is the danger that computing and telecommunications can come under attack as a cost sink, into which dollars are dropped, never to return in any form. Because so much of IT is not directly connected with the teaching/learning mission of higher education, that attack can be particularly vicious.

The Third Land: Panacea

While Utopia presents a vision of a whole set of optimistic ideas that shimmer in the distance, as a mirage, and Mundania is represented by plodding along and slogging through, we are also tantalized by Panacea. Panacea is even more tempting than Utopia. Can there be one special circumstance or nostrum that can solve our problems? There are forces that call to us, siren-like, over the tumult of increasing cost and complexity: these beckon to us to simplify, reject, finesse, or otherwise remove ourselves from the rough-and-tumble of technology. What about these?

--out-sourcing. The current darling of the trade press, with each instance of corporate use given great publicity, out-sourcing is facilities management in a more subtle guise. Many places that have out-sourced key information technology areas have failed to achieve the expected cost savings and have also found that the management task of controlling the out-sourcing organization is not as passive as they had hoped.

--the "death of the mainframe." Idealogues are persuaded that, because so much attention is being paid to desktop machines, the mainframe and its attendant complexity and cost, will disappear. And perhaps it will, at some point. In the meantime, the mainframe continues to serve as a large file server, a repository of vast amounts of data, and as a transaction processing machine for most organizations. In any event, the platform shift to the desktop is bringing its own costs and complexities to even more locations.

--user and departmental computing. A consequence of the democratization of computing is that resources are now much more widely spread in an organization. Removing the "high priests of data processing" from the picture was said to simplify technology for the common folks. Users now know that premise to be ironically false, as even the most naive LAN managers are thrust into technical complexity and tasks that they didn't know about before. And there are more of those tasks that will become hot topics in the future: security, documentation, standards, backups, licenses, disaster planning, etc. And do organizational costs go down? No.

--strategic planning. A standard shibboleth of most managers is that strategic planning will help either the organization get a grip on its IT situation or the IT situation will be forced to conform itself to the goals of the institution. Well. As a useful exercise to focus attention and provide a vision, strategic planning cannot be faulted. As Panacea, it fails, chiefly because information technology by its nature is very tactical. Often IT objectives are expressed in terms of the extreme emergency of the hour. Objectives beyond a year or two are very hard to deal with. Among many other reasons for this peculiar pace is that the speed of technological change destroys plans even as they are being written.

Preserve Organizational Health

In the midst of whatever running around needs to be done in Mundania, a key point is the need to preserve organizational health. Organizational health is defined as the ability of the personnel in the organization to continuously contribute to goals in better and better ways. This may be as simple as a preservation of morale issue. It may be as complex as not allowing financial exigency to chase off the superstars in the organization. The issue sometimes becomes one of management attention to the protection of talent. An information technology organization is defined by the talent it has, by the means by which that talent converts into useful activity, and by the encouragement that occurs for talent to continue to develop. We work in a dynamic field. Earlier, this paper discussed the need for staff development, certainly a key to organizational health, but there are other psycho-social factors that must be considered. Utopian solutions may lead to burn-out and terminal discouragement. It is never going to be good for a manager to insist on longer and longer hours or increasingly impossible deadlines: we have to back off and admit that working harder or even smarter may not pay off. We can't just throw new methods at people and expect them to train themselves. We can't try to motivate (pep-talk) people without some means of organizationally providing motivating factors: interesting work, recognition, promotion, appreciation. Organizational health can easily be destroyed by a heavy-handed approach in times of financial crisis. And, finally, we have to work hard to prevent organizational activity deterioration into solely a fire-fighting mode. The point to remember is that capability and talent need to be greatly encouraged at these times so that we can keep pace with future needs.

Conclusion

Mundania, the land where we live and work, is a land of great challenge. Neither easy answers nor hard work lead toward guaranteed success in information technology. But attention to personnel management principles, with the goal of preserving organizational health, is of paramount importance. Additionally, there are some investment strategies that can be used to provide for a better future. And there are several cost-savings ideas that need to be tried, because our institutions deserve shrewd and careful management in this time of financial crisis.

Acknowledgments: Ideas and encouragement for this paper were given to me by Marlene Gomez, Charles LeDuc, Ellen LeDuc, Margaret Massey, and Jean-Charles Ruf.

CAUSE 92

TRACK III

CHANGING RESPONSIBILITIES OF INFORMATION TECHNOLOGY PERSONNEL

Coordinator: Sharon R. Setterlind

With the widespread adoption of computing and information technology by students, faculty, and staff, the responsibilities of information systems and technology staff must shift to meet different needs and provide new services. Papers in this track include some of the creative approaches that institutions of higher learning have implemented.

Introducing Technology to Senior Executives: Theory and Practice—A Case Study

CAUSE92

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Abstract:

Introducing technology to senior executives, whether the technology is networking, electronic mail or an executive information system, requires a special approach. The difficulties are compounded when the executives have little background in information technology and are using their computer, if they have one, as a replacement for a typewriter.

At the University of Chicago we recently completed a project with the stated goals of:
(1) connecting the University's senior administrators to the campus-wide network,
(2) having each executive use electronic mail on a daily basis, and
(3) empowering the executives' direct reports through improved communications.

Our underlying (and unstated) goals were: (1) to give the executives a successful introduction to technology, (2) through example, to change the campus-wide expectations for technology and electronic mail, and, (3) to lay the foundation for the introduction of additional technology, such as an executive information system.

The project was a success. We believe that many of the approaches we used and the lessons learned are applicable when working with executives on any technology project.

The presentation will be directed at individuals from institutions with technology unaware senior administrators and will cover our methodology and its underlying theoretical base as well as provide project highlights.

Introducing Technology to Senior Executives: Theory and Practice—A Case Study

Presented at CAUSE92 by James H. Porter

I. Background

At the University of Chicago we recently completed a successful project which introduced networked computing and electronic-mail to over fifty of the University's senior administrators and their staff including the:

President

Provost

Vice President for Business and Finance

Vice President for University News and Community Affairs

Vice President for Administration

Secretary of the Board of Trustees

Secretary of the Faculty

Director, Financial Planning and Budget

This important, highly visible project, which was conducted under the sponsorship of the Vice-Provost for Information Technology, had a stated goal of providing electronic-mail to the University's senior executives. Other, unstated goals of the project were to increase the executives understanding of technology and to set, through example, expectations for electronic-mail and network use throughout the University.

Covered in this paper is a discussion of why we believed our senior executives should be connected to the campus network and use electronic mail, several theories on requirements that must be met before senior executives will use desktop computing, a description of our project organization and its execution, and a description of what we felt were keys to the project's success. At the end of the paper is a short description of the University's networking environment and the networked desktop computing environment we installed for our senior executives.

Like many similar technology-based initiatives, the key to success was not in installing the technology but in dealing with many complex *human* issues and concerns. The University's senior executives have many demands on their time and were not going to embrace new technology unless it provided a significant return for the time invested in learning its use. Likewise, the executives' support staff was very protective of the executives' time and was not prepared to support the imposition of additional demands upon the executives' and their time unless it would make their daily efforts more productive. There also existed a healthy and understandable skepticism of any new technology. As described below, personal relations, salesmanship, coaching and individualized training and support were key to the project's success.

II. Why Network the Executives?

Our senior executives, like many of their counterparts at other universities and in industry, have had a limited exposure to desktop-based computing technology. Prior to this project, most were using their desktop computers as typewriter replacements, with their usage limited, for the most part, to word-processing and spreadsheet application packages. While several support staff personnel had dial-up access to mainframe-based central administrative systems, only one senior administrator—out of the fifty personnel covered by this project—used dial-up electronic mail on a regular basis.

Our senior executives have also suffered through at least one earlier, unsuccessful attempt to introduce them to electronic mail. The previous introduction provided dial-up electronic mail capability to a small group of about twelve University personnel working on one special project. The introduction failed because the dial-up electronic mail interface was difficult to use and because of the limited user population and resulting low message volume. It was frustrating, according to one participant, to go through the involved dial-in and log-on process time-after-time to find out there was no mail.

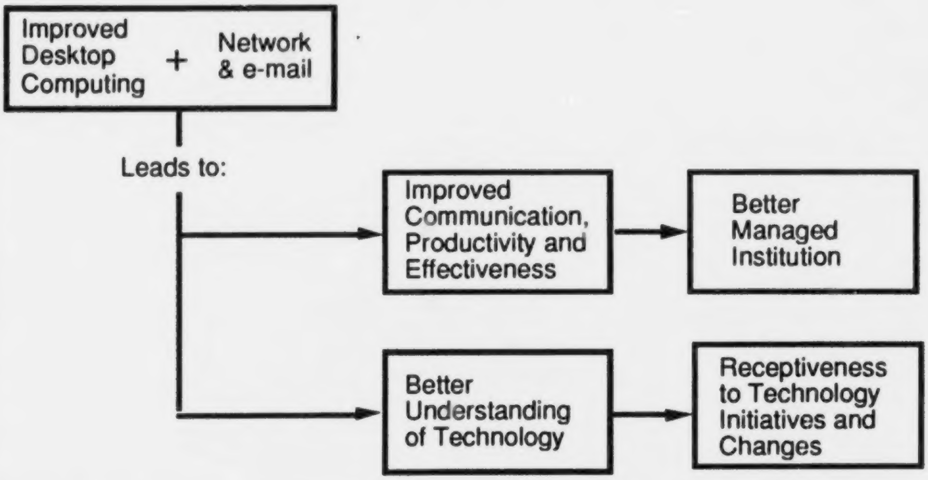


Figure 1
Why Is Executive
Computing Important?

Improved Desktop Computing
+
Network & e-mail
Leads to:
Improved Communication, Productivity and Effectiveness
Better Managed Institution
Better Understanding of Technology
Receptiveness to Technology Initiatives and Changes

We believed it was important for our senior executives to be connected to the campus-wide network and to use electronic mail on a daily basis for several reasons, including:

- The resulting improved communications would increase the executives' effectiveness and, just as important, the effectiveness of the personnel reporting directly to the senior executives. More effective senior executives would lead, we hoped, to a better managed University.

- Use of the network and electronic mail will lead to a better understanding of technology which will, in turn, lead to senior executives who will be receptive to new technology initiatives.
- Senior executives using electronic mail will, through example and by setting expectations, lead other University personnel to use electronic mail.

III. What Does it Take?

Very few senior executives will use new technology just for technology's sake. There has to be a net benefit from using the technology. Figure 2 indicates that we can increase the net benefit from using any technology by increasing the gross benefit or decreasing the required effort. However; as discussed below, a meaningful, easy-to-use system will not always be used.

Figure 2

$$\begin{pmatrix}\text{Gross Benefit}\\ \text{from Using}\\ \text{Technology}\end{pmatrix} \text{ minus } \begin{pmatrix}\text{Effort to Learn}\\ \text{and Use}\\ \text{Technology}\end{pmatrix} = \begin{pmatrix}\text{Net Benefit}\\ \text{from}\\ \text{Technology}\end{pmatrix}$$

For an executive to use any new technology, such as networking, video conferencing, executive information system or electronic mail, the technology must be:

Easy to use	The technology must be easy to learn and use. The less training required the better. For a computer system, a point-and-click environment is preferred to a character interface.
Meaningful	The technology must produce some benefit. The benefit from using the technology must be meaningful to the executive. An executive is not going to waste time using a technology even if it is easy to use.
Critical Mass	In addition to being easy to use and meaningful, a new technology must provide a critical mass of functionality. For example, a networked computer with electronic mail must become so important to the executive that he or she will turn it on the first thing in the morning, leave it on all day and routinely use it during the day.

We addressed the ease of use and meaningful applications requirements by providing a "point and click" microcomputer-based electronic mail system. The critical mass requirement was addressed as follows:

- Every effort was made to connect all direct reports and their staffs to electronic mail. We analyzed the organization to identify the groups that reported directly to each executive. We then worked with these direct report organizations to assist them in connecting to the campus network and to begin using electronic-mail. We accomplished this by providing training and consulting support, giving demonstrations, supervising contractors, pulling network wiring, establishing a telephone bridge to link remote local area networks to the campus backbone, and, in general, doing whatever was required to make each direct report unit a successful electronic-mail user.

- We increased the skill level of support staff personnel by providing individual and formal training in computing fundamentals, word processing applications, and e-mail. Increased skills, we believed, would lead to increased usage.
- Electronic-mail was introduced to an administrator only when:
  (1) his or her secretary was ready to provide day-to-day technical support for the administrator; and
  (2) all of his or her direct reports were available via electronic-mail.

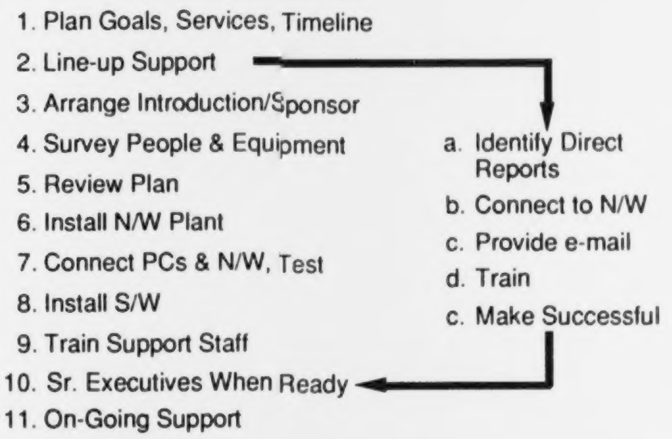
Timing was key. For each administrator, we designed the process to have in place a dynamic, active group of e-mail users, including all direct reports, before he or she was connected to the network. In several instances we used the administrator's anticipated e-mail use to co-opt non-users into the network (setting expectations) and then, once they were in, used the direct reports using e-mail as a way to set expectations for the senior administrator.

III. Project Organization

This project was sponsored by the Associate Provost for Computing. The project team included representatives from the University's administrative and academic computing organizations as well as representatives from Telecommunications and Campus-networking organizations. The project had two major thrusts as indicated in Figure 3. The main effort covered installing the network in the executive offices, activating electronic mail, training, etc. Just as important was a parallel effort to get each executive's direct reports connected to the network and using electronic mail. As mentioned above, having these direct reports available through electronic-mail was key to building the critical mass of electronic-mail users required to make the project successful.

Figure 3

Project Plan: Introducing Technology to Executives



1. Plan Goals, Services, Timeline
2. Line-up Support
3. Arrange Introduction/Sponsor
4. Survey People & Equipment
5. Review Plan
6. Install N/W Plant
7. Connect PCs & N/W, Test
8. Install S/W
9. Train Support Staff
10. Sr. Executives When Ready
11. On-Going Support

a. Identify Direct Reports
b. Connect to N/W
c. Provide e-mail
d. Train
c. Make Successful

We first determined the executives' direct reports and support staff. We next analyzed each executives' communication patterns by determining who he or she communicated with. We then took whatever steps were necessary to get those people to use electronic mail and to make their efforts successful.

Within the executive offices we engaged in a lengthy and extensive series of personal contacts with support staff, including:

- **Initial missionary contacts and demonstrations.** We had many repeat, informal sessions with the individual executive secretaries, executive assistants, and senior staff personnel. These initial visits included describing the network and electronic-mail and discussing how it could be used. Individual demonstrations of electronic-mail were arranged for the Provost's and President's assistants as well as for others who indicated more than a passing interest. These demonstrations were staged to simulate the executive's office environment with, for example, electronic-mail address books and simulated electronic-mail messages in place, waiting for the executive's assistant. In many instances we had several Computing Center personnel participate in the demonstrations by playing electronic-mail various roles such as President, Provost, etc.

- **Establishing a presence and learning personnel.** We established a relationship with every person in the executive offices. We learned their names, their job, their computing skills and experience, their desktop computing environment, etc.

- **Skill survey and training.** We used a formal survey supplemented by direct personal contact to determine each person's computing skills. Formal and individual training was designed to improve each person's basic computing skills and their use of word-processing, spreadsheets and other common desktop computing tools. Interestingly, our one formal training session, which utilized a skilled, experienced external instructor who presented a special course tailored for the participants was rated by all participants as a failure. Possible reasons for the course's failure include: (1) the participants, who were accustomed to our individual instruction and coaching, were not properly prepared to benefit from a group session; (2) none of the participants had previously attended a desktop computing training course and may not have known what to expect; (3) pacing of the course may have been too slow, leading to frustration; or, (4) the participants did not feel they gained sufficient new knowledge to warrant being away from their office for a full day.

- **Side-by-side problem solving and coaching.** We worked with each person to help them increase their computing skills and to do a better job. Where appropriate we introduced them to new tools, such as spreadsheets or access to services available via the network. We also assisted in establishing remote connections to the University's central administrative systems, improving filing systems, developing new manual procedures, etc. We were also involved in training new personnel when there was staff turnover.

- **Individual introduction of network and electronic mail.** Once the network was operational, we connected users to the network in groups—usually based on the LaserWriter they were using. Once the connection was complete, we gave the network several weeks to settle-in. We then installed electronic mail over several days based upon the same work group approach used to connect to the network. Each person was shown how to use electronic-mail as it was being installed on their desktop computer.

- **Informal sessions, demonstrations and contests.** Once electronic mail was installed, we worked to make sure it was understood and used. We held individual refresher sessions and demonstrations. To increase initial usage of the 'enclosure' feature, we held several contests. For example, the most original enclosure sent to the author won a prize. For the two weeks following installation we visited each person on a daily basis to see how things were going, to answer questions and to provide instructions on advanced features.

- **Identify and train local experts.** Within the senior executive's organization we identified several persons who are the unofficial *designated* technical resource persons. These are members of the staff that have an interest and skill in desktop computing, can answer many of the routine questions that arise on a daily basis and can do the initial trouble shooting when problems occur. (Is it plugged in?)

- **Recruit and train an electronic-mail administrator.** The electronic-mail package we installed requires a person to administer the electronic-mail server. This entails adding users, verifying performance, identifying problems, answering questions, reviewing logs, etc. We were fortunate to have a talented and skilled staff member volunteer to assume this responsibility. While this person has no formal technical training, she does an excellent job of administering the system—which literally requires only minutes each day. In addition to her electronic-mail administration responsibilities, she also administers the remote backups of all executive and staff computers.

- **Introduce senior executives to electronic-mail.** Once the executive's primary assistant was sufficiently skilled to answer basic questions that the executive might ask as he or she was beginning to learn to use electronic-mail, we introduced electronic-mail to the executive. This usually required about an hour of the executive's time and included an overview of the network and electronic-mail, a discussion of how it could be incorporated in the executive's daily routine and hands-on training in actually using electronic-mail. Prior to each session, in cooperation with the executive's assistant, we developed and installed electronic-mail address books for the executive, and had several direct reports and the assistant send actual electronic-mail messages.

- **Review mail-server logs for problems.** The electronic-mail package we installed produced daily logs of all messages sent and received. We monitored these logs daily for several months to identify and correct problems. The logs are now monitored by the electronic-mail administrator on a daily basis.

- **Frequent contact, priority response.** We continue to maintain periodic contact with all electronic-mail users covered by this project. We are also the first persons called when there is a problem with the network or electronic mail within the executives' local network. Needless to say, these problems get a priority response.

IV. Conclusions

The project was highly successful. All of the University's senior executives use electronic-mail on a daily basis. Several have incorporated electronic-mail into their daily routines, such that they find it almost impossible to function on the rare occasions when it is not available.

We believe that through the use of electronic-mail our senior executives will be receptive to the introduction of new technology and to technology-enabled organizational changes. However, only time will tell.

Technical environment for the Executive Offices

- **Desktop computers:** Most executives and support staff have Macintosh computers (50) with a few IBM PC clones (6).
- **Local area network:** The local networking capability is provided by Farallon's PhoneNet with a Farallon Star Controller. A Shiva FastPath provides the link between AppleTalk and Ethernet. The FastPath has been set to make the executives' local network *invisible* to the rest of the campus. With the local network invisible, it impossible for someone in the executive offices to inadvertently print on a printer outside of the executives' local network. It is also impossible for someone outside the local network to have access to file servers and other resources on the local network. Dantz's Retrospect Remote is used for Macintosh backup over the network.
- **Network wiring:** The University's standard wiring scheme at the time this network was installed was a cable containing four twisted pair of 22 gage copper wire. This wiring provides us the capability of upgrading to Ethernet over 10BaseT in the future.
- **Campus network:** TCP/IP over fiber.
- **Electronic mail:** CE Software's QuickMail. Cayman's GatorMail-Q provides the gateway between QuickMail and TCP/IP. The mail server is a Macintosh IIci with an uninterruptable power supply.

The Role of the CIO in the Curriculum Change Process

Panelists

Alton Brantley - Chief Information Officer, Director of the Center for Information Technology, and Associate Professor of Medicine, Penn State University Milton S. Hershey Medical Center

Lynn DeNoia - Executive Director of Information Technology, Bryant College

Barbara Horgan - Assistant Vice President for Information Services, Seattle University

Harry Reif - Assistant Vice President for Information Technology, James Madison University

Moderator

John Swearingen - Assistant Professor, Computer Information Systems Department, Bryant College.

The traditional non-involvement of the college or university CIO in the planning and development of curriculum is no longer appropriate. Academicians, while often delightful people, typically fail to engage in extensive long range planning, fail to consider adequately the impact of information technology across the curriculum (both in terms of the teaching process and in terms course content), and fail to integrate concepts or applications across disciplines or departments. The nature of information and of information technology is such that these issues must be considered if IT is to make maximum contribution to institutional achievement of educational objectives. In many institutions, the CIO is the single individual able, and in the strongest position, to foster the dialog necessary to ensure consideration of these issues. On the other hand, the CIO has many responsibilities other than curriculum. Participation in the curriculum change process becomes for the CIO, another facet of his or her role - a facet with which both the CIO and other members of the institution may be uncomfortable. The questions to which this panel proposed to seek answers were: What is(are) the appropriate role(s) of the CIO in the curriculum change process? What professional and personal preparation will best enable the CIO to fulfill that(those) role(s)?

This panel session included a summary of the results of a recent survey of the members of the CIO-L list-server regarding their role in the curriculum change process, and the sharing by four CIO panelists of the answers to the above questions suggested by their experience.

Response to the Questionnaire[1]:

Responses to the questionnaire suggest that the curriculum change process is a typically a formal, academic process to which only faculty and academic administrators have access. More than half of the thirty-three institutions responding formally limit participation to faculty and academic administrators, while the remainder appear to seldom encourage input from additional constituencies. Only ten percent of the institutions responding have any formal requirement for participation by the CIO. Perhaps, as a consequence, direct participation in this process by the CIO is typically infrequent, and when it occurs, typically on an *ad hoc* basis more likely at the behest of an individual faculty member than as a partner in the overall process. Not only is actual participation in the curriculum change process infrequent, but seventy-seven percent of those responding suggest that they are not linked closely enough to the process to obtain the information they need to do their job of providing and allocating resources or of promulgating a vision of IT across the entire institution. Acceptance of participation in the curriculum change process by the respondents can best be described as "mixed." Participation by some is sought; by others, tolerated. A number of comments make it clear that acceptance by "others" depends upon who the "others" are...perhaps more on a personal than a professional basis.

Most of the respondents (87^{+}%) felt that they were perceived by their community as "resource" persons with respect to issues directly, and perhaps solely, related to IT such as choice, selection, and acquisition of technology; availability or capability of specific IT resources; and long range policies or problems directly related to IT...less often (71%) as resources with respect to applications in the classroom or learning process. While most respondents (90%) believed themselves to be seen as a driving force for IT innovation throughout the institution, their comments suggested they view themselves as more closely linked to administrative IT than to the application of IT in the academic setting.

Recipients of the questionnaire were asked to assess the degree to which they perceive their participation to be necessary, and to give reasons for their answer. Three general conclusions may be drawn from the comments they provided. First, CIOs participate in the curriculum change process to a lesser degree than they believe appropriate. They view their participation as needed both from the view of obtaining the information required to enable adequate and appropriate resources to be provided, and from the perspective that IT should be (or become) a more significant part of the curriculum content or of the overall learning process.

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[1] A copy of the questionnaire and tabulated responses is available from John Swearingen at Bryant College, (jswearin@research1.bryant.edu)

Second, CIO participation in the curriculum change process may be as much a matter of the personal characteristics of the CIO as of one fulfilling the professional responsibilities of his or her position. This appeared to be particularly true in smaller schools, and in those schools (90%) having no formal mandate for participation. This suggests that until the role of the CIO in the curriculum change process is formalized, this role will differ from one institution to another, and, will depend perhaps as much on the characteristics of the individual filling the position as upon the characteristics of the institution.

Finally, the traditionally academic process of curriculum change is not something upon which the typical CIO feels comfortable intruding. Whether this is a cause or a consequence of the obvious lack of participation in the process was not clear.

Framework for the Panel Discussion:

The panel addressed and extended issues raised by the questionnaire under the following framework:

- present role
- future role
- personal skills required of the CIO
- critical factors/problems/issues

The Present Role

The degree of involvement of the panel members in the curriculum development process at their home institutions runs the gamut of those responding to the survey...from *ad hoc* involvement with individual faculty members seeking advice (Lynn), through being a required signature on a resource impact statement (Barbara), to formal participation on the committee governing undergraduate education (Alton). Each serves primarily as an operational or technical as opposed to a policy making or strategic resource with regard to the curriculum...but the specifics of their role differ from one constituency to another. As one might anticipate, panel member's roles are primarily reactive and lean more toward providing specific information or services than enhancing the process or facilitating coordination. For those faculty competent with and comfortable in the use of information technology, the CIO and other IT staff appear to serve primarily as facilitators, easing the way for these faculty by providing hardware and software resources and the answers to specific technical questions. For those wishing to make use of IT as part of the instructional or learning process in the classroom, the role might be characterized as that of a mechanic responsible for preparing or providing significant assistance in the preparation of the appropriate hardware, software, and process. For those faculty wishing to use IT resources in a laboratory mode, the CIO and his or her staff function primarily as service providers akin to a public utility. One might suggest that these characterizations depict a role which is passive, concerned with IT "content" as opposed to curriculum "process", and focused upon the technology.

The New Role

The desired role seems to differ significantly from the current role. All panelists seek a more active role. Each expressed the desire to participate more fully in the curriculum change process, and in fact suggest that their participation was becoming increasingly more crucial. They see the mode of participation, however, as changing from "IT content" to facilitation of a "process." The new role is seen, for example, as one which encourages, or even sponsors, discussion among faculty with regard to uses of IT in the instructional process; as well as one which may include espousing a particular institutional vision within the formal curriculum change or approval process. Discussion indicated that the current role of the CIO in the academic process is yet ill-defined; and that to a degree, the CIO and his or her staff may play similar, *ad hoc* roles, both within the curriculum process and within the larger institution. The appearance of the new role may come about simply as result of maturing process wherein the roles of the CIO and IT staff become separated, with the existing role inhering in the staff, and the CIO taking on an academic role similar to the strategic, visionary role they perceive themselves having in the administrative milieu.

Discussion also suggested that, especially with respect to the fulfillment of the new role, the position of the CIO within the hierarchical reporting structure is especially significant. Visions are implemented at the top! If, as CIO, one wishes to promulgate a vision of the role of IT within the organization, one is likely to be most effective when reporting near the top of the organizational hierarchy. In addition, since the future role of the CIO will be by nature that of an integrator or facilitator, it will often be useful to have the support, visibility, and institutional overview which reporting to someone at the top of the organization is able to provide.

One of the most difficult accomplishments of the CIO with respect to any academic process is that of gaining credibility with academicians, not for their technical prowess, but rather as a supporter of and advocate for the faculty. This suggests that the preferred structure might have the CIO reporting to the

President, Executive or Senior Vice President, or Provost. Such a reporting structure provides the support necessary within the academic constituency while providing the balance necessary to ensure similar support among administrators. Reporting to the Vice President for Academic Affairs or the Vice President of Administration may lead to the perception of "favoring" one constituency over another.

This new role may also foster greater use of committees ... committees not just as sources of information, advice or confirmation of decisions made by the CIO or other IT staff, but as setters of policy and makers of decisions.

Personal skills

The personal skills necessary to fulfill the new role will differ more in emphasis than identity from those presently expected. Certainly technical skills will still be required...panelists perceived credibility as a primary issue, and still consider credibility to stem from a perceived competence with technology. The success of a CIO in his or her new role, however, will be based more on the acquisition of appropriate personal and interpersonal skills than on an understanding of technological intricacies.

Creativity, flexibility, and the ability to conceive and articulate a vision will become of paramount importance. Until faculty at large become more aware of the larger role of IT both in the curriculum and in society, it may well be that the CIO may be called upon to provide the "vision of IT" around which the college or university operates both administratively and academically.

The CIO of the future will also need the ability to "think in the future", to accurately envision the role of information technology in our personal lives, in business and in the society of the future (while maintaining a pragmatic approach to ensure that change actually occurs). This envisioning of the future is actually a more difficult task than it may appear. Past forecasters of the "role of technology in the future" have often been quite successful at predicting the occurrence or state of development of the technology, but less successful at predicting the "role" of the technology. Those of us with a technological bent often over-estimate the rate at which the technology will be accepted by potential users and assimilated into the existing business or societal structures. We must remember that if a goal of the curriculum is to prepare students for life after graduation, the technology to which they are exposed during their education must be four to six years ahead of that which is currently the norm in the larger society. The CIO may, especially in the smaller institution, be the only person able to step back from a fascination with technology and

and raise the issues of such parameters as user acceptance and acceptability of application rather than simply abetting the popularity of a current fad.

Finally, given that the future role of the CIO is viewed as a facilitator, one who asks questions rather than one who provides answers...interpersonal skills will become increasingly more important. If the CIO is indeed to be a facilitator of the use of information technology in the teaching/learning process, especially among faculty of diverse disciplines, he or she must learn the language of instructional methodology, not the language of technology nor of a specific discipline. The CIO of the future may well be selected on the basis of his or her ability to communicate, especially the ability to listen, rather than on the depth of his or her technical knowledge.

Critical Factors/Problems/Issues

In terms of their role vis-a-vis the curriculum change process, panelists perceive three different kinds of critical issues or problems: organization-based, faculty-based, and curriculum-based.

Organizational:

At the organizational level, one of the roles of the CIO is to ensure that the use of IT in the curriculum falls within the context of the overall organizational strategic plan. In many institutions, this may require that the CIO foster the development of such an organization-wide plan, and then develop, in conjunction with the faculty, a strategic plan for the use of IT in the curriculum.

It has been noted earlier in this discussion that changes in the role of the CIO in the curriculum change process may be dependent upon the institutionalization of his or her participation in the process. A problem facing many institutions is then the formalization of the role of the CIO in this academic process.

Faculty-based:

At the faculty level, panelists highlighted two problems. First is the need to increase credibility among faculty, especially with respect to one's ability to facilitate process. Again, this underscores the importance of "people" versus "technical" skills.

A common, but not inclusive, characteristic of the panelists was that they felt a faculty appointment to be a useful albeit not essential adjunct to their CIO role. The perception seemed to be that this appointment enhanced their credibility with faculty and also allowed them to understand more clearly the issues raised. Similar notions have been voiced by other full-time academic administrators (Deans, Academic Vice Presidents, Provosts, etc.) This position also enables them to serve on insitutional committees that are faculty-based, and therefore allows participation with one of their constituencies during deliberations.

The second problem is caused by a dichotomy within the faculty ranks between those in positions of "leadership" in curriculum change (characterized by panelists as typically the younger, more mobile faculty members) and those in "control" of the curriculum change process (the older, tenured faculty). In many instances, the CIO may be the professional to form the bridge between these two groups.

Curriculum based:

There are at least two curriculum-based problems. First, the role of IT in the existing curriculum is as yet ill-defined. For the most part, IT appears in present curriculum models to fill the role of providing information, but "what?", "when?", and "in what form?" has, in many cases, yet to be determined. Second, we may be at the beginning of a change in curriculum philosophy to that of problem-based learning. Alton noted the implementation of such a curriculum at the Hershey Medical Center, and the notion is becoming a more popular topic for discussion in other disciplines, particularly business and engineering, as well. The role of IT in a problem-based curriculum changes from the traditional providing information to providing access to information and providing models with which to organize and analyze information. Such a change will likely require acquisition of new skills by both the CIO and the faculty members and is a process without which a visionary CIO is likely to be unsuccessful.

A Common Thread:

In viewing both the present and the future role of the CIO in the curriculum change process, there is a common thread. There is now, and likely will be in the future, no "universal role." The appropriate, and perhaps the "possible," role is dependent upon the institution, upon the specific constituency within the institution, and upon the technological knowledge and the personal characteristics of the individual holding the position. Given the increased emphasis on the need for "people" skills, the personal nature of success, especially in an *ad hoc* role will continue, and the existing diversity of roles will persist and, unless the role becomes formalized within the institution, increase in the future.

EMPOWERING USERS AS MEMBERS OF THE COMPUTER CENTER TEAM

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Abstract

Many colleges are faced with the problem of outdated administrative computing systems that consist of: 1) thousands of programs that have been patched to the point where it is almost impossible to follow the program logic in order to revise it to meet changing needs; and 2) dozens of flat files containing data that are redundant, inaccurate, and unable to be accessed by modern desktop based query tools. The extraordinary work that it would take to replace these programs with packaged software accessing a relational database makes the situation seem hopeless, particularly given the fiscal constraints and staff cutbacks that are endemic to higher education.

One college utilized the user community to perform much of the work involved in converting to a new system. The empowerment of these users was the critical variable which enabled the project to succeed despite the lack of resources to hire additional computer center staff.

Empowering Users as Members of the Computer Center Team

I. Background:

Potsdam College is a State University of New York (SUNY) college of about 5000 students. A few years ago its computer center was struggling with outdated administrative computing systems that consisted of thousands of programs that had been patched to the point where it was almost impossible to follow the program logic and dozens of flat files containing data that were often redundant, inaccurate, and unable to be accessed by modern desktop based query tools.

SUNY negotiated an agreement with a software vendor to provide packaged administrative computing software to SUNY colleges. The vendor's software solution featured an Oracle database. It had the potential to provide for distributed data, true client-server computing, and report generation utilizing SQL-compatible query languages. Potsdam decided to participate in the SUNY initiative to change hardware platforms, convert the data to an Oracle database, and install the packaged software.

The College purchased the admissions and recruitment modules, the student system, the financial aid module, the finance module and the alumni module. The student system included housing, meal plans, and event scheduling as well as the traditional student functions of registration, grades, academic history, and degree audit.

The computer center then outlined the tasks that needed to be accomplished. These included:

* retrain the systems programmer to work in a VAX environment;

* retrain the PL/1 programmers to write in C and to utilize SQL and SQR to generate reports;

* train a programmer to become the Oracle database administrator;

* set up validation files for each structured data field (e.g. specifying allowable room types, address types, student types);

* set up the rules that control the processes (e.g., billing rules, room assignment rules, mappings of majors to degrees, etc.);

* develop data dictionaries;

* develop data entry standards (e.g. upper case vs. lower case, abbreviations);

* develop data maintenance policies (e.g. identifying who can change an address);

* negotiate common and consistent procedures across user departments;

* clean up the old data, resolving inconsistencies and redundancies, and decide in which tables and fields to store the data in the new system;

* write conversion programs;

* modify the new system in order to meet SUNY requirements;

* test new processes and rules;

* troubleshoot and fix bugs with the new system;

* create reports to replace some of the over 1000 reports generated by the old system each semester;

* evaluate report generation methodologies to determine which might be appropriate for users to learn;

* define, set up, and test "views" of the data so that users will be able to generate their own reports;

* teach users how to generate reports;

* develop documentation;

* develop training plans and materials;

* continue to maintain the old system during the learning and implementation stages of the new system; and

* modify and test new releases distributed during the implementation stage of the new system.

The work that needed to be done to convert to the new system seemed overwhelming. The administrative computing staff at Potsdam College consisted of three applications programmers, one systems programmer, a director, an operator, and an office manager.

In order to leverage the efforts of the programming staff, selected users were asked to become part of the computer center team. This paper describes the ways in which users contributed to the project, what worked, and what we would do differently if we were initiating the project today.

II. Empowering Users:

The first action taken to involve users in the project was to set up a steering committee consisting of a high-level representative from the office of the Vice President for Academic Affairs and the directors of each office that would be using the new software for transaction processing. Members of the computer center staff served as resource people. The initial responsibilities of the steering committee were similar to those of the typical steering committee for a conversion project. It established timelines, for example, and it set overall policies. But this committee also promoted behavioral norms that significantly influenced the quality of user involvement.

One such norm was the stated expectation that inter-departmental disputes would be referred to the steering committee to resolve rather than become a discussion item at the vice-presidential level. This expectation empowered the steering committee and motivated the departments to negotiate compromises.

Another norm promoted by the steering committee was that programmers would not go to training unaccompanied by a user. Often in a conversion project, users are invited only to the training sessions that focus on their particular module. In this project, users were invited to all training, even technical training such as Oracle, SQL, and SQR. The steering committee set aside a portion of the project budget to pay the training fees, and the individual user departments paid the travel expenses. The participation of users in technical training empowered them to be equal partners in discussions with the computer center staff.

While the steering committee did help to move the project along by providing it with structure, legitimacy and resources, it soon became clear that the committee was too large and too heterogeneous to be of much assistance in the day-to-day implementation work of the computer center staff. To resolve this problem, module subcommittees were formed.

A typical module subcommittee consisted of representatives from the offices that would be using that module and the computer programmer responsible for implementing the module. Usually the director of the major user office would be a member as would the most computer literate person in that office. The course/catalog module subcommittee, for example, consisted of the registrar, the associate registrar, the director of transfer articulation, the director of academic services, the assistant vice president for academic affairs, and the director of institutional research -- all people with high levels of concern about the integrity of course records. The registrar served as chair.

The members of the module subcommittee received training in developing validation tables and in establishing Oracle rules. Some of this training was provided by the vendor and some by the computer center staff. The members discussed how their different offices processed data and negotiated the changes that needed to be made in order to take advantage of the functionality of the new system. Since each office would no longer have its own files, but rather share an integrated database, much discussion had to take place about resolving contradictions and inconsistencies among different offices. Fortunately, each of the module chairpersons had the skills required to manage meetings that often addressed highly political topics.

The subcommittee members developed the rules and the validation tables. They sought advice, where appropriate, from other members of the campus community. (The course/catalog subcommittee, for example, used the opportunity provided by the conversion project to have the faculty and deans review all course descriptions and characteristics.) The subcommittee made the decisions as to what data should be converted, how redundancies and inconsistencies should be resolved, and in which tables and in which format the data should be stored.

At times, the subcommittee would get stuck on a technical detail. Sometimes the group would not be able to figure out how a particular process worked or the implications of the various choices that the user was being asked to make during the running of that process. Because the subcommittee members knew their module so well, it was usually the case that if they did not know how something worked, neither did the programmer. These types of questions would be written up to be asked of the vendor consultant during the periodic visits the consultant made to the campus. Often, the majority of the time the consultant spent on campus was spent with users rather than with the computer center staff, another difference between this and the usual conversion project.

One subcommittee had responsibility for the basic demographic record of each person in the database. The subcommittee membership included representatives from the alumni office, the admissions office, institutional research, residence life and the records office. Due to the ownership that the different offices felt about their data files, this subcommittee had to make many political decisions that affected data integrity: who could change names and addresses and under what circumstances, what address types were needed, what data entry standards should be followed, which office's data should be favored in the conversion, etc. It sought advice as to how other schools dealt with issues and it asked for suggestions for compromises that might help get the subcommittee past some impasse. Fortunately, the chair of the subcommittee had the skills needed to negotiate compromise and was willing to ask for assistance when needed. So this group, which so easily could have been factionalized and made impotent, instead accomplished all of its goals.

Each subcommittee was responsible for testing the processes and reports that were being developed for its module. Midway through the project, the computer center began to be concerned that the testing was not sufficiently comprehensive nor was it integrated across committees. The steering committee was asked to establish a testing and quality control committee. This new committee took responsibility to develop testing procedures that followed the student record from the time it came in via the admissions module, through housing and meal plan assignments, course registration, grading, end-of-term processing, graduation, and resumption of studies as a graduate student. Each committee member was responsible for creating test records and defining quality standards. The work of the test and quality control committee is credited with the unqualified success of the first registration in the new system.

There still remained the problem of training the hundreds of people who used the old system to obtain information about students, courses, grades, and so forth. The old system was very easy to use, even though its functionality was limited and its information sometimes inaccurate. The new system, however, because it is function key driven and requires the user to navigate through SQL forms, is much more difficult for the casual user.

The institutional research office agreed to take responsibility to develop training materials, design keyboard templates, and conduct training sessions for the faculty and staff who needed to query the database. The institutional research (IR) office also agreed to field test query software and to train users how to generate reports. In preparation for these tasks, the IR office conducted a survey of the campus community to determine what information and reports were needed from the central database. The information obtained from the survey was used in the design of the training materials, the user report menu, and the report customization parameters.

III. Critical Success Factors:

In looking back to see why the implementation was so successful, we can identify the following critical success factors:

1) the computer center laid out the tasks that needed to be accomplished and this helped to focus each committee's energies;

2) the College made a heavy investment in user training;

3) each committee was chaired by a user with strong group management skills;

4) one or more computer center staff attended the meetings and provided technical support to the group;

5) the computer programmers enjoyed developing the technical skills of users; they committed time to it, and they bragged about the accomplishments of their users;

6) as talented people were identified in user offices, they were given leading roles, no matter what their official job titles;

7) every once in a while, we paused to celebrate our successes - with picnics, congratulatory cakes or funny certificates; and

8) when tempers got frayed, we took time to reflect on how far we had come and to create new strategies to reduce tensions and to build solidarity.

IV. Things We Wish We'd Done Differently:

Among the changes we would make if we had to start over, are:

* We would have gotten moving much sooner so that we would have had more time to create and test new reports and to train users thoroughly.

* We would have involved more users of the old system who were not from the offices doing the heavy transaction processing - such as department secretaries, counselors, etc. These users could have provided insight as to what

features of the old system needed to be replicated in the new system. (We were convinced, mistakenly, that everybody hated the old system. We found out once we implemented the new system that many people preferred the simplicity of the old system.)

* We would have had more faculty involvement. During the project, the College installed a new network and provided 80% of the faculty with desktop computers, mostly MAC's, hooked to the new network. Many of the MAC users were appalled by the difference between the user-friendly MAC interface and the cumbersome, non-intuitive interface to the new administrative system. If we had had faculty on our subcommittees, the development of easier-to-use interfaces would have received a higher priority.

* We would have attempted to build relationships with colleges that had been using the system for some time. The system is so powerful and has so much functionality that often we could not grasp the implications of the various system configuration options. Almost all of our outside-the-campus time was spent with the other SUNY colleges that had purchased the system. Since each of the SUNY schools was a new user, we had no opportunity to learn from more experienced users.

V. The Future:

Empowering users to serve as equal members of the project team made the project a success despite the small size of the computer center staff. It also changed the culture of the computer center to one that expects users to be involved in setting standards and priorities and expects inter-departmental discussion and negotiation of system changes. Examples of continued user involvement include:

1) The test and quality control committee continues to set documentation standards and testing rules. It supervises the testing of major system enhancements and rules on proposed changes in system options.

2) The institutional research office continues to play the major training role for users of the system. It is responsible for updating the training manual and for training users on system enhancements.

3) A student data coordinating committee, comprised of representatives from the records office, admissions, financial aid, bursar's office, and the computer center, meets weekly to discuss interdepartmental issues.

4) A proposal to establish a programming prioritization committee, comprised of representatives from each major user group, was approved. The committee will establish programming priorities once the implementation has been completed.

The continuation of user involvement beyond the end of the project was not expected nor planned for. It is an unintended but beneficial side effect of the project that is likely to have substantial impact on the quality of computer services for many years to come.

Creating New Synergies by Combining Academic and Administrative Computing

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Abstract:

During the twenty or thirty year evolution of computing in the college and university environment, the development of academic and administrative computing departments continued with little interaction at most schools. In the eighties, many schools combined the departments, realizing that there were opportunities to be gained in reducing duplication and providing expertise to a broader audience.

There are issues that divide the two departments, namely the confidentiality of information and the fear on the part of academics that producing payroll checks will take priority over teaching and research needs.

This paper will discuss the results of our merger at Lafayette College, the ways we have helped alleviate these fears and provide added value to our services to both academics and the administration without any increase in staff or funding.

This paper is a follow-up to an article written in June, 1990 for The Edutech Report entitled "Why Administrative and Academic Computing Hate Each Other". Excerpts of that article are included here as background.

Perhaps hate is too strong a word, but it sure seems like it fits when talking about academic and administrative computing folk. Why are discussions about these issues coming up now? Networking and downsizing. Academic and Administrative computing were able to remain completely separate entities on campuses that chose to structure departments that way until faculty, staff and students started asking for access to administrative data. While some have made such requests before, not until computers were connected to a campus-wide network did the community realize that it should be able to ask for and get access to data for applications such as on-line registration, department budgets, student accounts and more.

History: The two areas of campus computing were almost bred for sibling rivalry. In the early days of computing, administrative computing ruled. There were a few "power users" in academic computing that knew how to use the behemoth machines, but the university had to run, people had to be paid and administrative computing had priority. As computers became easier to use, and more necessary in academics, the number of users, budgets and support staff increased. On campuses where the two centers coexisted in the same quarters, they were split apart, and often divided between academic and administrative reporting structures. Academic computing was growing, computer science came into its own as a discipline; at the same time, college administrative staffs were growing, government regulations imposed more needs on administrative systems and more departments wanted to computerize their operations. The stage was set for competition in computing resources and staffing.

Priorities: What are the functions of the two areas? Administrative computing is a production facility producing paychecks, course schedules and personnel files among other jobs. Academic computing supports and encourages innovation, the kind of innovation that could bring an administrative system down at a moment's notice. Hackers are often the top computer science students testing out new-found knowledge. Administrative computing must resist "quick-fixes", and "new-for-the-sake-of-new software". Programming must be thoroughly tested before being released for use, a marked contrast to the student working on a project hoping that the professor doesn't check the one loop s/he can't quite get to work properly.

The role of both departments has been somewhat well-defined since they were established, though not in terms of each other. It is seldom that an administrator needs access to academic computing facilities or resources unless s/he is taking a course or doing research. Similarly, while faculty have considered the concept of being able to look at an advisee's student records a desirable one, until computer networks were installed, there wasn't much belief that it would or could actually happen. When it became apparent that faculty could connect to any of the academic mainframes, the next logical question was "why not the administrative system?"

Let's look at the administrative side of this. A committee or user's group probably works with the head of administrative computing to help plan priorities for programming and system development. Because of planning for budgeting and systems installation, scheduling for projects may be planned for several years out. When a campus is networked, a new priority becomes evident, that is faculty and student access to administrative data. How should administrative computing prioritize this new area against its existing "clients"? Who among administrative users, members of the administrative computing committee or in the administrative computing department will argue for faculty and student access taking precedence over "their own" projects that have been on the books for long time periods? Furthermore, will all projects for administrative users ever be completed, thus allowing a space in the schedule for network access issues?

Personalities: Probably most because of the difference in priorities, the personalities of the individuals in the two departments can add to the friction. Administrative computing staff must be thoroughly detail-oriented because of the significance of the data passing through its systems. While programmers in academic computing are responsible for making sure their systems work, an error usually doesn't cost as much either financially or time-wise as one in administrative computing. If there is a bug in an academic program, it could cause problems in a class and get a few people mad, put if the payroll program crashes there are major repercussions for administrative computing personnel. These pressures are reflected in the types of people hired in each department.

Visibility/Exposure: When was the last time your school newspaper ran an article about administrative computing? Compare that to the exposure that new computing labs, software development and new networking applications get. Of course, if all students received bills that were incorrect, there would surely be lots of talk about administrative computing. But generally, most students and only a few faculty actually consider that there may be another computer center on campus aside from academic computing. Sheer number of users makes academic computing, its foibles and follies, more visible to a greater number of people.

Networking issues: If there is friction between the two computing centers, network access to administrative data could bring on a full-fledged conflict.

> Security: One of administrative computing's chief responsibilities is make sure that data stored on the system is safe. Password and terminal access is closely monitored. Allowing access to the system or its data poses a threat to the security measures that have been developed and employed successfully for years.
>
> Who "owns" the data?: In discussions about data ownership, some school policies say that the university owns all data and therefore a decision to share it can be

made centrally. At others, each department owns its own data, the registrar, financial aid office, business office, etc. are in-charge of who uses data they are responsible for. Getting these departments to agree to data-sharing is not always easy.

Legal issues: Many states and the federal government have very specific rules concerning what data can be accessed by whom. The individual is given rights to that allow her/him to see her/his own records and to prevent access to those records by others. These rules should be incorporated into the administrative systems and need to be dealt with when network access to administrative data is provided. Issues such as "does a faculty advisor, a department head or a professor who teaches a student one course have the right to see a student's record without his or her permission?" must be dealt with carefully by administrative computing personnel and academics.

Paper versus electronic access: It is often simple to draw parallels between paper and electronic data access. In the above example, if a faculty member can ask the registrar for a paper copy of a student's transcript without the student's permission, shouldn't that institution allow the same access electronically? Often a distinction in policy between the two means of access is made when the end-result is the same.

Reporting structure: If the computer centers were split apart 20 or more years ago, chances are that administrative computing reports to an administrative VP or financial person and that academic computing reports to a provost or academic VP. When each center had divided responsibilities, this structure may have made sense, but networking changes that. When priorities cannot be agreed upon by the respective department heads or computing committees, who negotiates a treaty, the vice-presidents? the president of the college? How much computing experience do the people that these departments report to have? Are they qualified to negotiate technical topics, or does the more knowledgeable vice-president, or the loudest computer center department head win the debate? Should the president be involved in these discussions if the administrators are not computer-aware? If not, how should these debates be resolved, by committee?

Schools that have a "computer czar" or one person that was ultimately responsible for both computer centers are in a better position to discuss and settle territorial issues than are schools with completely separate reporting structures. Separate departments at many schools have led to a long history of competition and dislike amongst computer professionals in the two areas.

Though networks have integrated many campuses, only a few colleges have true links between academic and administrative systems. Access to administrative computers by academic users is minimal at most institutions. Some have allowed access to selected users; "divided traffic" permitted access while ensuring security. In some cases, though the two systems were interconnected, the administrative system was invisible to academic users.

What Happens When You Combine Operations?

Reorganizing computing is no different than reorganizing any other department. There are fears and insecurities to deal with.

The background provided above shows many of the obstacles to a successful reorganization of computing. When staffs have little or no contact and then are thrown together, there is a potential for problems, especially if a position is eliminated in the process (i.e. one of the two Directors).

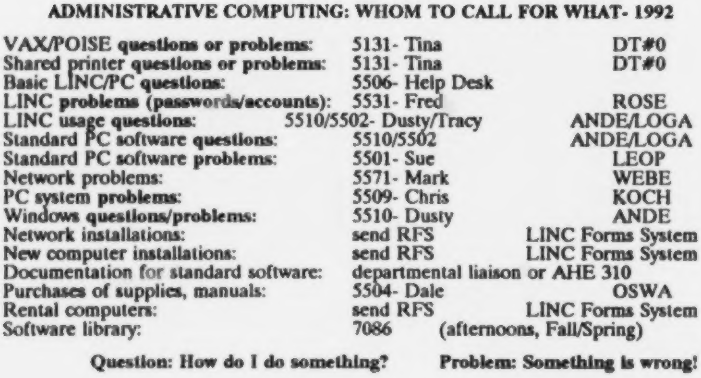
It is important to look at Computing Services from the clients' perspective. In many cases, a client of administrative computing has several places s/he has to call for assistance; an administrative programmer for help with administrative software, a user services person, perhaps in academic computing, for help with word processing and maybe network and hardware departments if applicable. When these departments are organized into separate units, the end-user can become frustrated by a lack of communication between these departments. For example, the client may call networking because they can't print to their shared printer; they may be referred to hardware and the problem may actually be the printer set-up in their word processing program. This issue is one of the key reasons for combining operations.

Traditional administrative users may be confused about whom to contact for assistance because they were used to calling one person, i.e. the programmer or support person for their module. Once they start using PC software, they become a client of traditional academic computing and networking resources, support, training and documentation.

In a combined department, situations like the ones above can be resolved easily by e-mailing others involved in case the problem is not solved in the first office. This also helps to educate the various staff members about what to look for in the future. It's not that this couldn't be done if there were separate departments, but it often isn't because of the way these departments were set up.

One of the key advantages to combining operations is that no person is left to be "just the programmer", "the repair person" or whatever. Regular meetings and discussions broaden the experiences of staff members who learn some of the ins and outs of each of the functional areas. At the same time, this increase in knowledge of who does what can help people in their specializations because other members of the department have a better idea of who does what and what questions get referred where.

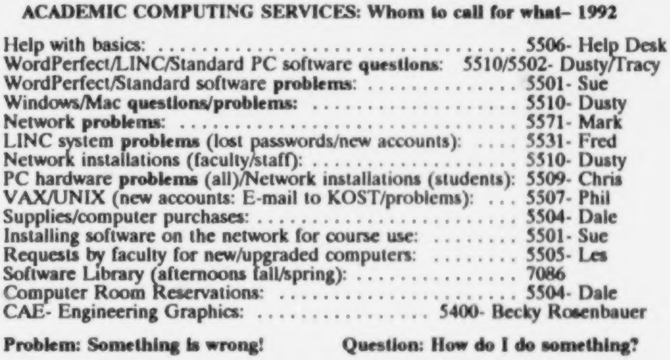
Sample WHOM TO CALL FOR WHAT cards from Lafayette:



ADMINISTRATIVE COMPUTING: WHOM TO CALL FOR WHAT- 1992

VAX/POISE **questions or problems**:	5131- Tina	DT#0
Shared printer **questions or problems**:	5131- Tina	DT#0
Basic LINC/PC **questions**:	5506- Help Desk	
LINC **problems (passwords/accounts)**:	5531- Fred	ROSE
LINC **usage questions**:	5510/5502- Dusty/Tracy	ANDE/LOGA
Standard PC software **questions**:	5510/5502	ANDE/LOGA
Standard PC software **problems**:	5501- Sue	LEOP
Network problems:	5571- Mark	WEBE
PC system **problems**:	5509- Chris	KOCH
Windows **questions/problems**:	5510- Dusty	ANDE
Network installations:	send RFS	LINC Forms System
New computer installations:	send RFS	LINC Forms System
Documentation for standard software:	departmental liaison or AHE 310	
Purchases of supplies, manuals:	5504- Dale	OSWA
Rental computers:	send RFS	LINC Forms System
Software library:	7086	(afternoons, Fall/Spring)

Question: How do I do something? **Problem: Something is wrong!**



ACADEMIC COMPUTING SERVICES: Whom to call for what– 1992

Help with basics:	5506- Help Desk
WordPerfect/LINC/Standard PC software **questions**:	5510/5502- Dusty/Tracy
WordPerfect/Standard software **problems**:	5501- Sue
Windows/Mac **questions/problems**:	5510- Dusty
Network **problems**:	5571- Mark
LINC system **problems** (lost passwords/new accounts):	5531- Fred
Network installations (faculty/staff):	5510- Dusty
PC hardware **problems** (all)/Network installations (students):	5509- Chris
VAX/UNIX (new accounts: E-mail to KOST/problems):	5507- Phil
Supplies/computer purchases:	5504- Dale
Installing software on the network for course use:	5501- Sue
Requests by faculty for new/upgraded computers:	5505- Les
Software Library (afternoons fall/spring):	7086
Computer Room Reservations:	5504- Dale
CAE- Engineering Graphics:	5400- Becky Rosenbauer

Problem: Something is wrong! **Question: How do I do something?**

A combination of departments also provides the opportunity to create focus groups on topics that transcend traditional departmental boundaries. These might include user services, networking and training as examples.

The other key issue in combining operations is alleviating the concerns of users that one department or the other will be stronger or that paychecks will take priority over academics. One way we've dealt with these issues is to keep the two systems separate so processing of administrative information never competes with academic work for system time. There are emergencies, for example, power outages, when one system has to be brought up first. In that case, administrative computing is usually the priority thought this rarely delays anyone more than a few minutes in actual processing time. The argument of one "side" dominating the other can be dealt with with proper management, good relationships between the two houses and especially ongoing work such as the aforementioned focus groups.

IT in Education and Staff Development

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Abstract

The University of Melbourne, a large public university, has embarked on implementation of an IT Strategic Plan which envisages widespread adoption of IT throughout the academic and administrative functions of the university.

The presentation will report on two programmes commenced in 1990, the Staff Development and Training in IT programme and the Interactive Multimedia programme. These programmes are aimed at providing staff with basic IT skills courses for acquisition of familiarity with new workplace applications, such as wordprocessing, document and information retrieval and new administrative systems and fostering close cooperation with IT, educational and academic departments to explore and develop applications of IT to teaching and learning.

Introduction

The University of Melbourne is the second oldest university in Australia and has a special place in the Australian Higher Education System and in the Victorian community which derives from its particular academic strengths and history. The University has a continuing commitment to excellence and leadership in education and research and to assist its staff, students and community to develop to their full potential. The University in 1992 continues to exhibit leadership in the acquisition of competitive research grants and in the number of government and industry-supported Cooperative Research Centres in which it is a key participant. With ~30,000 students and over 4,600 academic and general staff, the University is one of the larger Australian tertiary institutions.

Until 1987, there were 19 universities within Australia, but at that time the federal government abolished the binary system which differentiated colleges from the universities and initiated a programme of rationalisation through amalgamations and affiliations. There are now ~37 universities in the Unified National System with a wide range of cultures, communities, resources and teaching and research aspirations.

The federal government, with state government strategic and policy input, regulates the Higher Education System through 'educational profile' negotiation, whereby each institution agrees a funded student load, both undergraduate and postgraduate, on a planned system-wide basis. Federal funds also provide the largest source of research grants and have over the past few years been increasing targetted to encouraging industry participation and to areas of national priority.

Overall, throughout the 1980s, the per capita student funding provided by the federal government to institutions dropped in real terms (22% between 1975 and 1987 and another 6% since) and enrolments increased without commensurate increase in academic staff numbers, raising the student/staff ratios. The current economic climate in Australia has tended to increase pressure to further increase intake with most institutions accepting over-enrolments and continuing pipeline effects, beyond funded load, to ensure students have access to tertiary education. Institutions are being encouraged to broaden their income base to other than the federal dollar but there are still severe constraints on how this can be done - there are restrictions on fee-paying Australian students and until very recently in funding for new capital works. The result is that many institutions now have a high exposure to income earned from fee paying overseas students, an educational export earner that is encouraged by the government but which may need to be re-structured into educational partnerships and twinning arrangements to match other national aspirations. In some institutions, federal funds now only meet 50-60% of the operating budget, a dramatic change from even five years ago.

The federal government is committed to a programme of increased equity and access to universities and to increasing the participation rate across all age groups. The government has, for a number of years, been pro-actively exploring new initiatives to increase access to education, including the use of new technologies and delivery modes. Given the high current unmet demand for places, the "Clever Country" initiative, and the almost certainty that resources will not increase commensurate with enrolments, it is clear that the government and the institutions are looking to new teaching and learning methodologies and to increased use of IT to enable the planned objectives to be met.

National Initiatives

Since the mid-1980s, the federal government has pursued the objective of retraining and up-skilling of the workforce on several fronts. Under the jurisdiction of the industrial commissions, award restructuring and wage increases have been linked to structural efficiency principles supported by broadbanding and multi-skilling. Staff education is now recognised as a life-long process and job-related skills need to be continually upgraded/renewed.

In 1990, the federal government instigated the Training Guarantee Levy whereby companies and institutions, with an annual payroll greater than a quite modest threshold, had additional tax levied unless proof was supplied that the company had engaged in an approved programme of staff education and skills development of an equivalent value. Educational institutions were not exempt but could normally acquit their obligations through traditional study leave programmes. Educational institutions were however, de facto, approved providers and companies could acquit their obligations through attendance at appropriate courses or by donation to an institution as long as the funds were used to construct training facilities. This led quickly to a number of growth activities at the margin particularly in 1990 and 1991, before the economic downturn, in information technology related areas where the growth in services was anticipated, staff skills were being upgraded and companies were re-equipping.

The University, in order to better support the strategic move to a more devolved management structure, upgraded its Staff Development and Training programme to better empower and train supervisors and middle-managers and upgraded the IT skills programme.

After review, the federal government in 1991 produced a set of quantitative measures, or performance indicators (the Linke Report), claimed to be relevant to the process of effective management of the higher education sector. In 1992, the government formed the Committee for the Advancement of University Education (CAUT) and will shortly announce the award of a number of National Teaching Development Grants to individual academic staff in institutions to assist in the development of new methodologies/courses to improve the quality of teaching and learning. A Committee on Quality Assurance in Higher Education will shortly be established. In November 1992, the federal government announced the release of the Mayer report on key competencies and nationally consistent assessment and reporting as part of a concerted national effort to improve post-compulsory education and training. Members of the UNS and professional associations have already expressed some concerns over aspects of the report.

Several Distance Education Centres have been established to develop and exploit alternate modes of educational course delivery and, in the Open Learning Initiative, the government is seeking "to tap into the potential economies of scale available from wider (satellite broadcast) delivery of a very substantial body of materials currently available in the DECs", and thereby meet cost-effectively unmet demand nationally and overseas. In the second phase of the OLI, the government has foreshadowed, in a request for consultancy, the use of a national communications network for the provision of open access to information resources and student services. There is amongst UNS members a feeling that the rapid explosion in technologies has overtaken the original DEC programmes and that an urgent review is required to ensure that all universities do in fact benefit from identification of and access to best educational practice.

Strategic Planning

Throughout the 1980s, the University engaged in a number of IT planning exercises. The first, in 1984, focussed on the "Future of Academic Computing" and set up the framework for the development of the University Network and supercomputing facilities for research support. The University Network, now nearing the maturity stage, links all buildings on and near campus through a 100-megabit/sec FDDI optical fibre ring and those departments close to campus and to several kilometres distance through infra-red laser and microwave technologies.

In 1987 and 1988, the second and third reviews, respectively involving Wordprocessing and the central Computing Services, recognised the need to adequately support desktop services to the increasing number of microcomputers in department offices and on staff desks. In 1989, the University published its first IT Strategic Plan for the triennium 1990-92 and formed a new department, Information Technology Services (ITS), charged with implementation of the plan. A new committee of Council, the IT Policy Advisory Committee, was constituted to monitor the implementation of the IT Plan and to continue planning on a rolling triennial basis. ITS was formed by the amalgamation of the academic and administrative computing functions and of the data, voice and video reticulation networks. The Library was independently reviewed in 1991 and a joint Library-IT committee formed to develop a Library-IT Strategic Plan and a basis for consistent planned provision of information services.

The objectives of the first IT Plan in 1989-91 focussed firmly on network infrastructure, rationalisation of central facilities and staff development and training. The 1991-93 IT Plan continued this focus with particular emphases on acquisition of common hardware and software platform technologies, service development and a programme to educate all staff and postgraduate students in generic skills that would underpin administrative, research and teaching applications. The IT Plan envisaged that these programmes would be integrative and synergistic.

Currently all twenty four objectives in the 1991-93 IT Strategic Plan have either been met or substantially exceeded, in particular:-

- (Recommendation 14). All members of staff be encouraged to become computer literate in the context of their own discipline or work environment through staff development policies and the availability of special courses in Information Technology.
- (Recommendation 15). By 1993, every student in the University have access to the local area network for the purpose of interchanging information with staff and other students and facilitating access to online library materials. The recommended ratio of laboratory workstations to full time undergraduates is 1:10
- (Recommendation 16). Installation of the Interactive Multimedia Laboratory be completed in 1991.

The objectives were achieved through a process of resource redeployment and professional development and retraining of staff in ITS while reducing the overall budget demand.

In 1988, the University developed its first statement of its Aims, Guiding Values and Objectives which provided the framework for its first three-year Strategic Plan. In 1991, a process of review and refinement led to the publishing of a new three-year plan titled - "A Commitment to Quality" in which the University reaffirmed its determination to strive for the highest international standards in teaching and research. In the case of teaching, the University was faced with increasing student/staff ratios, overcrowded teaching and library spaces and tutorial session attendances that almost precluded a quality learning experience for the individual, a prime commitment of the institution. In its 1991-93 Strategic Plan, the University stated as a specific goal that it would:-

- continue to develop the use of new information technologies in all aspects of the life of the University, including its application in the development of new teaching methodologies, in support of research and in the development of information systems to improve the quality of management

In August 1991, the Centre for the Study of Higher Education, within the University, mounted a national conference on the Quality of Education which contributed significantly to the national debate on the issue. The CSHE plays a major role in initiatives to improve the effectiveness of large group teaching with new approaches to teaching and learning and in the use of technology for new delivery modes.

Whereas formerly planning focus had been on the input to the educational process, increasingly the quality of the process of learning and the educational outcomes are being assessed both by the federal government and the institution itself. There is national debate on the relevance on the application of a common set of skills and competencies to the university system (as opposed to vocational and professional training) and the University has initiated programmes in Quality of Education and Academic Audit to ensure that course objectives are clearly defined and that the academic processes are subject to audit and feedback, not least amongst the student body. The University has also decided that the quality of teaching is increasingly taken into account in consideration of the work of staff for the purposes of decision making relating to promotion.

Basic Skills Programme

Prior to 1990, Computing Services provided instruction in the use of central computer systems and packages and in some wordprocessing packages, mostly on a fee-for-service basis. In achieving the technical objectives of the 1989-91 IT Plan, it was recognised that IT deployment on the scale planned could only assist in achieving the institutional objectives if a systematic programme of staff education and generic skills transfer was quickly put in place. With ~6,000 workstations deployed on campus, ~2,000 in ~80 student laboratories and ~4,000 in departmental, staff and postgraduate offices, it was essential to build and maintain a skills set to support word processing and spreadsheet, access to administrative, research and library systems and to overseas databases. In addition almost all staff would be registered for electronic mail purposes and a number of mail gateways maintained. The University was also re-engineering and redeveloping all its administrative computer systems (using the Ingres RDBMS) and wanted to support a mix of functional and client-server access using a common user interface. In addition, the move to broadbanding and multi-skilling implied a workforce with a high mobility and common skills requirement.

With over 7,000 staff and postgraduate students, provision needed to be made to educate 2,000-3,000 staff per year. The University established an Information Technology

Centre in early 1991, refurbishing an old garage complex with 9 computing laboratories fitted out with a range of Macintosh, IBM and Unix workstations. One of the laboratories was used for open student access and another as an administrative systems demonstration area and graphics visualisation laboratory. The IT Centre was established through a part grant and part loan, with the loan repayable to the University over four years following acceptance of a business plan with objectives:-

- support for the generic skills programme
- support for Training Guarantee Levy activities
- commercial courseware delivery for vendors
- support for departmental course delivery
- provision of multimedia delivery capability

It was agreed that no more than 25% of aggregate capacity would be used for commercial activities. In particular the ITC provided a secure and managed environment for faculty and departmental wishing to develop courses prior to seeking ITPAC and Faculty support for the establishment of local facilities.

Staff in the newly formed ITS, from all support sections, redesigned and documented courses to meet the generic needs. In addition, given that the University has a heavily devolved computing infrastructure with over 50 large Banyan servers and over ~60 Apple Macintosh departmental file servers, courses were constructed in LAN and Server Management to reinforce prudent data management and administrative practices. In 1992, these practices were endorsed by the Auditor and Council as University policy and are promulgated through a "Defensive Computing Strategy" document. A number of central automated data archival and recovery processes have been put in place to support all departments.

The Computer Skills courses were designed to be modular and to have, as far as possible, similar elements for Macintosh or IBM PC compatibles. This facilitates skill updates and part-time attendance. The basic skills courses are free to all University staff and postgraduate students and, in toto, comprise 30-35 hours attendance in the laboratories. The courses have clearly documented objectives and staff are provided with resource guides, sample scripts and course notes. A short course is provided on using the Australian Academic and Research network (AARNet) to access resources nationally and overseas, for example for bibliographic database searches. A number of intermediate and advanced courses are also provided to build on the generic skills courses such as in spreadsheet, wordprocessing and network administration and a number of presentation aid courses are under development for assisting academic staff.

The figures below do not include facilities hirings and course delivery on a commercial basis nor for structured use by University departments or the Interactive Multimedia programme. ITS also encourages self-teaching and work-group based instruction under conditions where appropriate standards can continue to be met, for example where a drafting office wishes to build on generic skills in CAD/CAM outside the mainstream of campus-wide activities.

Course delivery in 1990-92 is summarised as follows (BS = Basic Skills; IA = Intermediate & Advanced):-

IT Training

Participants	1990	1991			1992		
	184 courses	307 courses			255 courses		
	Total	BS	IA	Total	BS	IA	Total
Academic	216	596	28	624	277	51	328
General staff	838	1271	211	1482	919	260	1179
Postgraduates	138	517	17	534	426	97	523
Undergraduates					15	6	21
Senior Staff		44		44			
Externals	117	28	24	52	24	19	43
Total	1309	2456	280	2736	1661	433	2094
(%)	100	90	10	100	80	20	100

An interesting feature of the above is the 'senior's course'. Senior staff were surveyed to assess the 'reach' of the programme and this revealed that ~50 Deans and Heads of Department had not attended the basic skills courses, which may have been due to reticence in the lack of keyboard skills or to lack of time. Special 'fast-track' versions of the basic skills courses were held in the evening at low student/staff ratios in order to encourage participation by this key group. Feedback in terms of improved participation rates by heads and their staff and in relation to course content was very positive.

Another key element not included above is staff development and training support for the rollout of new administrative computer systems to user and service departments. ITS staff designed and built the systems in consultation with users and both online and training documentation were generated. Each laboratory session (of 1/2 day) accommodates 15 staff and the delivery on this and the aforementioned programmes is:-

Sessions Booked

Client	1991	1992	1993+
Academic Depts	88	46	134
Admin. Depts	32	270	135
IMLU	0	75	14

(+) to date

Administrative systems rollout, for example, would include the 400 staff needing trained in the use of the new student administration system and in structured query languages (graphical query generation and client/server at an advanced level) with approximately the same for the Human Resource and Financial Systems. In 1992, under the National Priority designation, the University was awarded a grant by the federal government, for the CSHE and ITS to jointly develop specifications, systems and indicators (indices) suitable for assisting Deans and Heads to develop Quality Programmes and to incorporate these into staff development activities for senior academic staff.

IMLU - The Interactive Multimedia Learning Unit

In 1989, ITPAC decided to sponsor an initiative from the Institute of Education to explore the use of Macintosh systems in innovative course delivery, having earlier had experience with Apple IIe systems used in primary education. An Interactive Multimedia Laboratory (IML) was set up in the Institute by ITS and equipped with a small number of state-of-the-art workstations and media devices. Following enthusiastic reception of a number of small scale pilots and prototypes during 1990, the University decided to establish, within CSHE, an Interactive Multimedia Learning Unit (IMLU) with the mission:-

- to promote and demonstrate to staff the effective use of interactive multimedia as a means of improving the quality of teaching and learning
- to commercialise the University's interactive multimedia skills and products and to establish joint R&D projects with other institutions and industry

IMLU was therefore established as a seeding agent and a catalyst to help staff in faculties and departments build on basic skills and presentation aids and to develop alternate delivery modes and courseware more suited to the interactive student-centred mode of learning and to large-group teaching and student self-assessment. Taken with other initiatives, such as the delivery of course notes through WAIS (CWIS), IMLU is an important change agent in creating a climate and culture whereby more of the institution's teaching materials are made electronically more accessible whether through local or wide-area networks.

Earlier federally-funded projects in the DECs had shown that it was essential in the development of multimedia materials to form project groups headed by the academic staff member and serviced by a small group comprising the IT and media specialists. It was also important to avoid continually re-inventing the wheel, given the initial high costs of development. IMLU planned to achieve its twin objectives of staff development and course deployment through the use of such project teams. A Resource Library and Titles Database would be built and linked into US and UK programmes and a number of awareness and facilitation exercises worked through with faculties. IMLU initially had two full-time academic staff members supported by ITS in the IML, used as a development environment, and in the ITC, configured as the delivery facility. Two other full-time staff joined the IMLU team in 1992 alongwith a number of media and IT specialists on secondment. In 1991, the University made available some project development funds and 12 academic activities were seeded and monitored. Approximately half the projects came to fruition inside the allotted timeframe but the others suffered from lack of academic staff time and had to receive further assistance.

Based on this experience, IMLU and CSHE bid for and won federal support in 1992 under the Quality of Education programme for large group teaching and multimedia course development. The funds were used to release key academic staff for up to a semester for course design and development and, taken with increasing support being made available by faculties, substantially boosted the programme. Immediate benefits of this strategy have been to enhance our teaching across the science and engineering disciplines, to contribute new methods to architectural design and to complement teaching programmes in physiology and pharmacology practical classes. Students can now replay laboratory work with a much reduced demand on animal tissue and specimens. In Chemistry, following review of a videotape of current laboratory practices and effectiveness and the conducting of a pilot in 1992, all of the first year student intake will have laboratory instruction in a controlled and safe multimedia walk-through in the ITC in 1993. The University will make additional funding available in 1993 for three major new projects in Agriculture, Medicine and Law and, through the 1992 CAUT Grants, hopes to have a number of new seed project started. IMLU, in 1992, has a number of commercial activities in train.

In 1992 and following a one semester trial in the ITC, The University, as an extension to its well-established audio-visual facilities, upgraded its Horwood Language Centre to multimedia capability for the support of language teaching and in particular Asian Languages.

Summary

In a period of rapid change such as the Australian Higher Education System is undergoing, it is important, given the external pressures, not to lose sight of the longer term institutional objectives. The University's commitment to excellence in its teaching and research programmes and to the welfare and development of its students and staff remain paramount.

As part of its current three-year Strategic Plan, the University has made a substantial investment in information technology for staff and students, particularly in provision of workstations and teaching facilities and in development of multimedia programmes and projects. An infrastructure improvements programme is underway to upgrade selected teaching spaces with network access and multimedia display facilities. In the not too distant future, it is expected that the need for physical presence on campus for information gathering will diminish as increasing network capacity will facilitate remote study with access to information resource databases. Technology will be used to enhance the quality of rather than displace the teaching and learning processes, particularly for large-groups.

With the current concurrence between technologically-driven change in the workplace, the use of technology in the University in the academic programmes, in administrative systems deployment and staff empowerment and in federal government initiatives to try to secure higher and more cost-effective access while retaining quality improvements, the pace of change is dramatic. As always, our ability to maintain and secure the benefits of change depends on the continuing professional development of staff, the fostering of innovation and in cultivating the 'climate-of-change'. The focus of ITS has changed from the traditional computing and data centre one of meeting operational requirements to be more user focussed, to meet current and future user needs through project identification and partnership and to pro-actively design and market professional and staff development IT education programmes.

The resource shifts necessary to go through the transition phase need not be large,but the strategies need to be carefully selected. Thirteen ITS staff members have been involved in teaching ITC courses, ten of these allocate 10% or less to training as they have other task commitments. The cost of contracting out the additional courses has been ~$10,000 and postgraduate students have proven very effective in course delivery. In the case of IMLU, the two positions made available by the administration have been augmented through faculty resources and the bidding for and winning, as with ITS, of federal grants.

Acknowledgements

The author would like to express his appreciation of the efforts of staff in ITS and IMLU who have carried the above projects through over the past three years and of the many academic staff who are taking the ideas and prototypes through to deployment in mainstream courses.

Will the Last Central IT Person Please Turn Off the Lights

by

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Ten years ago, John Naisbitt articulated the coming of a number of societal changes which were to have enormous impact on organizations at all levels. In this paper, three of Naisbitt's trends are revisited and shown to be closely interwoven with the pressures to move toward distributed computing. We also explore the chaotic behavior these movements exhibit and present the plans being developed at ASU to enable decentralization while maintaining the coordination required to provide continued support for executive level decisions.

Will the Last Central IT Person Please Turn Off the Lights[1]

Chaos

"It's not good. We will lose our jobs."

An East German checkpoint guard commenting on the fall of the Berlin Wall.[2]
Also spoken by an ASU employee about the changes in AIT.

This is the tenth anniversary of Megatrends[3], the book which articulated ten major organizational waves that were beginning to re-shape our society. Three of those are of particular interest for our discussion. They are the movements from:

Centralization to Decentralization
Hierarchies to Networking
Representative to Participatory governance

During the last few years we have seen how remarkably accurate these predictions have been. One need simply reflect on the collapse of the USSR to see the results of these trends on an international scale. On the national level, huge companies like Ford, IBM, and others are reorganizing in ways which look remarkably like the movements within the computer industry to "downsize" or "rightsize". The pressures to reorganize the information technology functions at Arizona State University (ASU) provide an example of these same phenomena working on a local scale. The effects of these changes have been nothing less than chaotic for our community as it struggles to adapt to a new order.

By a remarkable coincidence, this is also the tenth anniversary of Benoît Mandelbrot's[4] popular publication of his mathematical discoveries in *chaos* . While not providing any relief from the uneasy feelings reflected in its name, chaos does provide a mathematical means of describing these multi-scale changes. The mathematics also reveals that such changes may well be the result of "...order melting smoothly into chaos."[5] That is, not as a result of some drastic alteration in the way things are done but just a small change in one or more 'parameters' which have input into the process.

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[1] Mr. Conrad thanks Rita Conrad for her many helpful suggestions and support in preparing this paper.

[2] Newsweek, Special Report, The Wall, November 20, 1989, page 23.

[3] John Naisbitt, Megatrends, Warner Books, New York, 1982

[4] Benoît Mandelbrot, The Fractile Geometry of Nature, W. H. Freeman, New York, 1982

Cause or Effect

"What a curious feeling! I must be shutting up like a telescope!"
Alice[6]

Information technology was one of the parameters which changed. In fact, Naisbitt and Toffler[7] both credit the innovations in information technology with providing much of the wherewithal to effect these changes. It is ironic that the very organizations which enabled this technology and acted as agents of change should find themselves so soon awash in the waves they helped create. To better understand how these multi-scale movements are affecting computer organizations, consider each of them and their inter-relatedness as they apply to technology organizations. The movement from centralization to decentralization is exactly the phenomenon of distributed systems. The decentralization movement recognizes a limitation of central systems in that they *cannot know* many of the little details ('small parameters') which have large effects locally. It removes the "high priest" aura many central authorities have cherished and elevates the importance of business concerns over technology concerns.

Distributing systems also makes the trend of replacing hierarchies by networks imperative. It is a fact that bureaucracies slow down the flow of information and thereby risk the competitive advantage which information can give an organization. "Channels and cubbyholes"[8] is an excellent description of bureaucratic organizational behavior as well as an apt description of the communication barriers such organizations impose. The trend is to move away from a rigid hierarchy of authority toward an active network of peers. These peers must have expertise in a wide range of subjects, understand specific business concerns, be capable of dealing with informational issues from a technical viewpoint, and be able to keep a broad perspective on a problem. Such an employee is generally educated and highly trained. It is no surprise, therefore, that they demand more direct input into decisions and this is helping to drive the movement toward participatory management.

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[5] Douglas R. Hofstadter, Methmagical Themas: Questing for the Essence of Mind and Pattern, Basic Books, Inc., New York, 1985, page 364.

[6] Lewis Carroll, Alice's Adventures in Wonderland, annotated by Martin Gardner, Bramhall House, New York, 1960.

[7] Alvin Toffler, Powershift: Knowledge, Wealth, and Violence at the Edge of the 21st Century, Bantam Books, New York, 1990

[8] Ibid, page 165.

This shift toward decentralization emphasizes the inability of our bureaucratic organizational structures to make quick adjustments when needed. Information technology organizations have become such bureaucratic structures and have suffered the same lack of flexibility. They have also made specific errors of their own. For example, many have:

> Provided technological solutions which took no account of business needs.
>
> Allowed development backlogs to grow to a ridiculous size (hundreds of person-years in some cases) in order to lobby for additional resources.
>
> Installed development methodologies which guarantee a three-to-five year development time frame and slavishly stick to them even when it has become clear that speed is essential.
>
> Been slow to recognize the opportunities provided by technological innovation and the empowerment these can provide for non-technical staff.

During this economically difficult time, executives have responded to this suite of disappointments by making substantial reductions in technology budgets.

Paths to the Future

Would you tell me which way I ought to go from here?"
"That depends a good deal on where you want to get to."
"I don't much care where."
"Then it doesn't matter which way you go."

Alice and the Cheshire Cat[9]

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[9] Carroll, page 88.

While it may have been only small changes in certain forces which precipitated things, the changes now required in IT organizations to respond must be dramatic. Every organization wishes to have some part in deciding its future and 'knowing where you want to go' is an essential part of selecting the right path. If your goals include total dedication to customer satisfaction and working to eradicate errors, then help in selecting a path has been provided. James Penrod and Michael Dolence[10] have done an excellent job in capturing the essential principles of change which must occur within higher educational enterprises (and the IT organizations within them). Similar principles have been put forward by Richard Murray and Richard Hardin[11] for changes within IT organizations in business. We provide a joint summary of these in the following:

> Provide a strategic plan for IT which is founded upon organizational goals and values and provides a clear and compelling vision for the organization.
>
> Build an IT organizational culture which supports:
>
> | | |
> |---|---|
> | Innovation | Entrepreneurialism |
> | Sharing | Continuous learning |
>
> Maintain a holistic view of the enterprise.
>
> Create a new style of leadership which encourages participative decision making and empowers the people responsible for getting the job done.

With this as a backdrop, let us turn to the ASU experience with its recent series of organizational changes and efforts to "decentralize" the academic computing portion of its IT organization.

Arizona State University is in the throes of dealing with the results of these movements. In particular, with the shift to distributed academic computing and the shift towards a distributed staff approach to supporting academic computing. These two shifts are only casually related since one could have any combination of them. For example, distributed computing with central support, central computing with distributed support. However, both these changes are targeted at achieving the same general goal: customer empowerment. We are trying to find ways to provide services that give our customers more control over their environment.

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[10] James I. Penrod and Michael G. Dolence, "Concepts for Reengineering Higher Education", CAUSE/EFFECT, Volume 14, Number 2, Summer 1991, pages10-17.

[11] Richard J. Murray and Richard C. Hardin, "The IT Organization of the Future", Information Systems Management, Fall 1991, pages 68-72.

The present budget crisis has only served to accelerate the need for changes since we must do a better job leveraging the resources which are available. Up to this point, we have been structured in a very typical way: central academic computing with central support. The faculty have been reasonably satisfied with the support delivered over the years but their own budget problems have heightened their desires to have more control over their technology environment. The two key budgetary forces driving these changes are:

- The Information Technology department has roughly half the budget for capital acquisitions that it did just two years ago -- we no longer have the funds to buy mainframes; and

- The need for computer support locally in the colleges is mushrooming while the ability of the colleges to deliver that support is sharply curtailed -- they are cutting faculty and classes and simply cannot afford to provide additional support services.

There are a number of different ways of responding to these imperatives that would maintain the status quo. For instance, we could simply move to a model of buying used mainframes near the end of their useful life cycle in order to reduce the capital requirements. (In fact, we've already done some of that.) Or we could simply say the support problem in the colleges is their problem and just ignore it. (We've done some of that, too!) However, the budget reductions combined with the social forces toward decentralization have encouraged an approach that will help further empower our customers as well as respond to the budget reductions.

Distributing Computer Support

"A technology that informates can have a corrosive effect on the hierarchical organization of work, but its transformative power finally depends upon a series of crucial management choices."

Shoshana Zuboff[12]

New Support Structures. The Computing and Network Consulting Services department within IT (CNCS) is in the process of establishing a more decentralized computer support structure. This support will be centrally managed and academically integrated in order to better meet the academic computing needs of the colleges and to better support the move towards distributed computing. While many members of the CNCS staff will be physically distributed to the colleges, a reduced central staff will continue to provide a suite of key services. In order to ensure we are distributing to the greatest extent possible, we've tried to approach this with the assumption that all services should be distributed ... and only centralize where necessary. Appendix A, shows which services will be retained.

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[12] Shoshana Zuboff, In the Age of the Smart Machine: the Future of Work and Power, Basic Books, Inc., New York, 1988, page 285.

Transforming support. The new support structure will be less hierarchical and more of a networked and collaborative structure. In the existing hierarchical structure, customers contact central support whenever they have a question or problem. If the central staff cannot help, they escalate it to the vendor. In the new networked structure, customers will contact their local distributed support person who will either address the problem or contact other distributed support staff for assistance. If they cannot address the problem, an assigned distributed support person will contact the vendor for further assistance with no involvement by the central staff.

New tools. We are working on a tool that will facilitate the "networking" aspects of this structure. We need something that will allow customers to electronically ask questions or report problems, allow consultants to respond electronically, capture the responses in a data base, and allow the consultants to easily search the data base. This tool must be intuitive and easy to use. It must allow us to deliver services 24 hours a day, 7 days a week, and be available to the customers as well as staff. Today, our support staff can go to the office next door or down the hall to collaborate on a question or a problem; the tool is intended to serve as an electronic substitute for staff proximity. We hope it will help relieve the sense of isolation about which many of our staff have expressed concern.

Phone consulting will continue to be provided centrally. We are planning to use students to staff a bank of "hot line" phones. The students will be trained to handle lower level questions and escalate the more difficult items to the permanent staff. All staff -- both central and distributed -- will respond to calls escalated from the hot line.

Centrally Managed. For this concept to work, central management must add value to the structure; otherwise, it would be more effective to simply parcel out the FTE to the colleges. We believe there are a number of crucial ways in which CNCS can add value to the support function:

- CNCS can provide consistency in problem solving thereby increasing the effectiveness of the distributed staff.
- We can coordinate different approaches to a problem and assure a 'best solution' is communicated to the campus.
- We can assure that technically 'right' solutions prevail over technically 'wrong' ones.
- We can provide the variety of expertise which is just not possible to attain with two or three people.

Some support needs will change over time. A centrally managed staff will allow us to respond to these changing needs. For example, a college may need a networking expert for 2 months to help plan and implement a network. However, after the network is in place, that college may want to concentrate on an instructional technology project for the next 6 months; followed by something else later on. Or a college may need access to someone with Macintosh expertise, but only part-time. Central management will allow coordinated staff assignments to be made with the right experts for the right amount of time and change assignments as needed.

CNCS has many staff members with in-depth expertise in a variety of areas. While assigning them to work in specific areas will give them more general responsibilities, central management will allow us to retain and develop their expertise as institutional asset through project and development assignments.

Finally, central management will allow us to offer career-paths for the technical staff. Opportunities in any one department or college are necessarily limited whereas we will be able to offer further professional growth and development across the institution and improve ASU's chances of retaining highly qualified personnel whose talents are in high demand.

Separating roles. Under the current plan, there are 3 types of support services which can be provided. The appropriate mix of services will be determined for each college:

1) Full-time assignment of a staff member to a college or department to provide on-going local support.

2) Part-time assignment of a staff member to provide on-going local support on a limited basis; or

3) Project assignment of a staff member with in-depth expertise to support a project with a start, an end, and a specific deliverable.

CNCS will provide the staff member a personal workstation appropriate to the assignment, basic documentation, and the formal management structure. Each college will provide office space, office furniture, a telephone, and an Ethernet connection. Each college will also provide a college-level coordinator responsible for providing local work direction and for resolving conflicts or issues internal to the college. The leadership in each college will be responsible for selecting the mix of support required for its faculty, staff, and students.

In order to deliver the value-added support discussed above, 20% of each staff member's time will be retained to serve in a central capacity. This 20% reserve for central functions is intended to be flexible -- e.g., not one-day-out-of-five -- but can be attained as an average percentage over time with the details negotiated with the college or department.

Distributed staff will have central functions . The 20% time reserved for the distributed support staff to serve in a central capacity will be spent in a variety of ways:

- Providing "networked" support to other distributed support personnel in other colleges and departments;
- Participation in development assignments (projects) in a particular technical discipline which will aid the institution overall and retain and hone their expertise.
- Giving and/or attending training sessions in a particular technical discipline which will aid the institution overall and increase their expertise.
- Attending staff meetings to remain in touch with other CNCS staff members and keep posted on the latest technical activities. and
- Attending departmental meetings where knowledge about what is happening in each college will be shared and a

context within which technology is being utilized can be provided.

Conclusion

"But in the time of parenthesis we have extraordinary leverage and influence - individually, professionally, and institutionally - if we can only get a clear sense, a clear conception, a clear vision, of the road ahead."

John Naisbitt[13]

ASU has not embarked on a total reengineering program but it is taking its first, halting steps toward a new and uncertain future. Change is always traumatic and a change that involves shifts in paradigms is particularly difficult. Much patience and understanding by both management and staff are necessary to make the transition to the new order successful. Initial staff reaction was shock, followed by denial, a desire to negotiate alternatives, and, finally, acceptance. These are the phases of grief one feels with any major personal loss and it must be recognized that changes of this magnitude are a death-rebirth process. It is our hope that these changes will provide a rebirth for ASU's technology department and a better working environment for everyone.

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[13] Naisbitt, page 252.

Appendix A:

ONGOING CENTRALLY SUPPORTED FUNCTIONS

The following functions will continue to be centrally supported:

Network Support: Management and support of the network is fundamentally a centralized activity. Distributing management and support of the network would expose the institution to an unreliable and ineffective networking environment.

Student Support: Operation and support of the IT Academic Computing Sites as well as the associated student consulting support provide a critically important base of computing resources for our students that cuts across disciplines and colleges. The ability of any student to go to any of the Sites and receive basic services -- regardless of their college affiliation -- and the availability of around-the-clock service make these Sites a key resources for our student community. This flexibility would be lost if the function were distributed.

Training Coordination: Coordination and delivery of training is fundamentally a centralized function. Central coordination will provide the ability to pull together the best resources from across the institution for delivering training classes and/or for putting together classes utilizing off-campus resources for the best pricing.

Electronic-Mail Support: E-mail needs to be a centralized function in order to ensure implementation of a set of e-mail packages that are adequately integrated and to provide reliable delivery of electronic information.

Printing Distribution Support: As computing becomes more distributed, the need to provide convenient and affordable printing to the campus will also grow. All customers should have access to a high volume printer as needed on a convenient and affordable basis. A centrally managed set of strategically located printers will address this need.

Site Licensing and Distribution : There will be an increased need for central coordination, negotiation, and distribution of site licenses here on campus as we move to a distributed computing paradigm. Discount pricing and an improved legal standing are the benefits of a centrally managed approach.

Facilitate Information Sharing: Another need in a distributed computing environment, will be to provide adequate documentation for commonly used products. Plus, we need to better utilize technology to deliver information and consulting/problem resolution services electronically over the network. A central function is needed to coordinate preparation of the information, distribute the information, and monitor and maintain its overall quality and relevance.

Presentation Graphics Production: All disciplines in all colleges share the need to prepare publications and presentations using the most effective tools available whether it be slide, display graphics, or video production. The equipment involved is expensive and requires specialized expertise. This is a function where the economy-of-scale argument still applies.

Visualization Lab and Support: All disciplines in all colleges share the need to better understand and interpret the results of their research activities. Visualization techniques can often yield new insights and a greater understanding of computational results. The equipment involved is expensive and requires specialized expertise. This is also a function where the economy of-scale argument still applies.

Research Programming Support: There is a critical need for discipline specific programming expertise in the colleges to support the research faculty. Ideally, this support would be provided by distributed staff. However, this kind of discipline specific background can only be provided by specialists in each field (e.g., physics, mechanical engineering) and the limited number of experts we will have also need to collaborate frequently on programming techniques and common technical problems. Therefore, we propose keeping this as a central function, but with a clear assignment for each expert to provide support to one or more specific academic units.

Statistical Support Lab: The need for an on-campus focal point to provide consulting and support for statistical methods and software is a critical research support function. This need cuts across disciplines and colleges. This function will be overseen by the interdisciplinary Committee on Statistics.

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TRACK IV

SETTING POLICIES AND STANDARDS FOR USER SUPPORT

Coordinator: Louise S. Lee

Increasing user independence coupled with increasing dependence on information technology presents new challenges in providing effective support. Papers in this track examine the dynamics of establishing policies and standards to sustain our changing role.

Establishing an Information Architecture Integration with an Open Systems Environment

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Abstract

This paper describes the conceptual basis for a structured data architecture, and its integration with the deployment of open systems technology. The key strategic initiatives which brought these efforts together are discussed: commitment to improved data access, migration to relational database technology, deployment of a high-speed, multi-protocol network, and orientation to workstation-centered computing.

Details of Indiana University's data architecture are presented, focusing on the relationship of operational to information-detail databases, the creation of synthetic data structures and higher order "data collections," and the integration of the university-wide architecture with local and departmental data sources. Discussion of the underlying technology paradigm addresses the integration of proprietary components with "open" systems solutions in a strategy of technology coexistence that addresses: mainframe/server, workstation/client, networks, gateways, and database management systems. Finally, some next critical events are outlined for both the architected data environment and the open systems technology environment.

Establishing an Information Architecture
Integration with an Open Systems Environment

Background and Context

The ideas presented in this paper about data architecture and open systems derive in large measure from trends and ideas that are moving through the entire information technology community. Beyond that, the paper discusses how these ideas have been shaped and implemented in the specific computing environment of Indiana University. Two aspects worth noting about this specific environment are the overall university organization, and the organization of university computing services.

Indiana University is an multi-campus university system. It enrolls more than 90,000 students, and maintains a very high degree of integration and interdependence among its eight geographically dispersed campuses: a single academic school (division) may span multiple campuses, offering the same degree program in multiple locations across the state; faculty regularly teach in more than one location, often during the same academic term; similarly, students enroll concurrently on more than one campus; the university experiences a high degree of inter-campus transfer on the part of students between semesters; and so on. To support this degree of multi-campus interdependence, in most areas of administrative data processing there is a single set of information systems, centrally managed by one computing and information services group, that supports the entire university in all its geographic locations. Thus, size and geographic diversity, balanced against the expectation of close integration, are among the constraining factors that must be accounted for in any technology planning and decision-making.

University Computing Services is a merged academic/administrative computing organization whose mission includes: providing administrative computing services to all eight campuses of the university; providing inter-campus network services among all eight campuses; and delivering or enabling the necessary support structure for these state-wide services. In addition, University Computing provides more intensive computing service support to the Bloomington campus in the areas of instructional and research computing, student computing, and intra-campus network management. A very small set of key strategic initiatives has provided much of the cohesive and motivating power to the computing organization. These initiatives, initially developed in 1989, during the structuring of the current organization, and refined in the time since than are: to develop a high-speed data network; to promote workstation-centered computing; to deploy relational database management systems; and to promote widespread access to data. As with the facts of life about the university, the mission and strategic initiatives of University Computing provide some of the constraints and boundaries that inform the technology plans and decisions of the organization.

Data Architecture

As used in this paper, *data architecture* is a design and analysis technique based on the macro-level analysis of data within an enterprise. The result of this analysis is a general purpose model for the structure and deployment of *all* of an enterprise's data, regardless of data subject area.

One part a data architecture model is primarily descriptive in nature, beginning with recognizing variations in the general nature of data within the enterprise: detail data vs. summarized data, real-time data vs. point-in-time ("snapshot") data, etc. The data architecture model also takes note of the variations in intended uses of data: transaction processing, front-line customer service, management reporting, decision support, institutional research, etc.

A second component of the data architecture is more prescriptive in nature. It specifies, for the entire enterprise, standards for information synthesis: how summarized data are derived from detailed data, how standard points-in-time are determined for creating "snapshot" databases, etc. The data architecture model also assists in technology selection and evaluation. By knowing the general form of data, its intended use, and some of the associated performance requirements, the data architecture can help specify the standard or recommended technologies for deployment of different categories of data.

Put otherwise, data architecture is modeling the process of information synthesis, the creation of useful information from lower-order forms of data. The general model produced by data architecture analysis helps to identify or establish authoritative data sources, and to define stable relationships among multiple instances of the same data (frequently in different forms or stages of synthesis) that are used for different purposes in the enterprise. Data architecture also helps assure predictable transformations of data throughout the process of information synthesis. Finally, data architecture helps match the technologies used for data deployment to the intended use of the data.

There are in the information technology industry three or four threads of discussion that are directed toward this same set of data architecture issues. The first to come to our attention was the work of Bill Inmon on "data architecture" and, more recently, the "data warehouse" concept. (1,2) Subsequent to much of Bill Inmon's pioneering work, IBM unveiled its "Information Warehouse" framework. (3) And, in partnership with IBM, Information Builders, Inc. developed their product offering of Enterprise Data Access/SQL (EDA/SQL). The final industry thread that we have followed, and one that looks especially promising in terms of where we want to take the information architecture of Indiana University, is Apple Computer's VITAL (Virtually Integrated Technical Architecture Lifecycle), a conceptual model of information systems design and information access. (4)

An Approach to Design of a Data Architecture

Having put in place a few basic concepts and principles, the clearest introduction to the concept of a data architecture is to look at one. Figure 1 is the basic data architecture model developed for institutional data (also called administrative data or management information) at Indiana University.

The first key point to note is that the model divides data into three strata: Operational, Information Detail, and what are called "Collections." At the lowest level (Operational) are those data used in the day-to-day operations of the enterprise: business transaction processing, data capture/data entry, real-time customer service, etc. At the second level (Information Detail) are the idealized representations of an enterprise's data, minus the redundancies and anomalies that are a natural part of any set of operational information systems, but still having a nearly one-to-one correspondence with the business objects represented by operational data and still maintained at the finest level of granularity. At the highest level (Collections) are found synthesized information products, derived from lower order and more detailed data sources. These collections may be summarizations of detail data, selected extracts, aggregations from multiple detail sources, etc. The metaphor applied to this three-level model is:

Operational ==> Manufacturing
Information detail ==> Wholesale
Collections ==> Retail

Three other points to note about the model in general. First, the movement of data within the model is one-directional; the process is one of refinement and synthesis, and there is no downward flow of data in this model and no back-loading of data from higher-order forms to lower. Second, all business transaction (update) processing occurs at the lowest level in the model, the operational; information detail and standard collections are read-only data and are never updated directly. Finally, the model recognizes the need to integrate enterprise data with local data, both as a point-of-origin (in local operational data) and as a final destination (in collections of information for local analysis and decision support).

Data Architecture and Indiana University

The development of the data architecture concepts and their implementation has been, and will continue to be, a long term process for Indiana University. From our current vantage point we see the process as having four steps: 1) separating operational data from information detail; 2) refining the information detail; 3) developing standard collections; and 4) integrating enterprise data with local data.

Step 1: Separation of operational data from information detail.

In this step separate physical storage locations and formats are created for operational data and information detail data. Separate storage is justified, even required, because of the way these two classes of data differ from each other in terms of typical use and performance requirements.

Operational data are typically retrieved one record at a time; retrieval is of a specific record or set of records, identifiable by key; and records are frequently inserted or retrieved for update processing. Additionally, operational data are typically being retrieved interactively -- for on-line transaction processing or real-time information display -- and so require response time in seconds (if not sub-second response).

Information detail data are typically retrieved in sets of many records; defined sets of records are typically retrieved based on secondary (non-key) characteristics; and records are virtually never retrieved for update processing, all access is read-only. For most information detail purposes -- analysis, reporting, and decision support -- response time in minutes, if not hours, is sufficient.

Given the different uses and performance requirements, separate physical implementations can make use of data design techniques appropriate to the needs of each class of data: for example, operational data stored in highly navigational databases tuned for on-line performance and single record retrieval, and information detail stored in databases having multiple secondary indexes for searching and set-selection.

Aside from structure and performance, one more reason for separate physical implementations is the need for information detail to have a stable set of values over some period of time. Operational databases are in a constant state of flux; they are the place where the business transactions of the enterprise are recorded in real-time. Reporting, analysis, and decision-support require some stability of data so that comparative analyses can be performed, iterative analysis can pursue a line of inquiry on a stable set of data values, and the same results can be replicated by multiple users of the same data. Accordingly, one requirement of the information detail is that it be a time-variant replication of its operational data counterpart, having stable data values from a defined point (or points) in time.

At Indiana University, a two-part environment of transaction-oriented, operational data and fixed-value, replicated information detail data was first implemented in the early 1980s. This initial investment in data design has had great value over the past ten years providing a widely-used end user reporting environment. It also forms the foundation on which further stages of the data architecture model can be built.

Step 2: Refining the information detail.

The second step, at least for Indiana University, is a refinement of the information detail data environment that has been in place for the past ten years. In an organization just beginning to implement a data architecture model, most of these refining tasks would be accomplished in the initial design of information detail data.

Our chief tasks of data refinement are: development of a university-wide, conceptual data model; migration of the information detail data environment from indexed and sequential storage formats to relational database formats; and resolution of anomalies and redundancies in the data structures by determining authoritative sources for each atomic data item.

A project to develop a university-wide conceptual data model, in four component pieces, was begun in 1991. The first two components, a conceptual model for student data and one for university financial data, are complete. Remaining to be done are models for employee data and physical facilities data.

Also begun in 1991 was the migration of existing information detail data from older storage formats to relational database format, using DB2. Thus far only 5% of the information detail environment is converted. (Though we know, too, that the critical mass of data that we absolutely must migrate to relational format -- to meet the majority of the university's access and reporting needs -- is far smaller than 100%.) The strategy now in place for further data migration is to follow the progress of the university-wide data model projects, focusing initially on the student data model, and to address those data subject areas identified in a user survey as the greatest need for access: class schedule data, student enrollment and advising data, financial account status and budget data, and others

Step 3: Developing standard collections.

Using the three-stage model described earlier, this step in a data architecture is intended to allow information delivery to move from wholesale to retail, to organize and package data in ways that are more ready to use. The process is one of synthesizing information from the information detail, and the chief tools of synthesis are summarization, aggregation, selection, and point-in-time representation. All these are transformations of data that one typically finds in user-designed reports, queries, or data selection/extract programs.

The term "collection" refers to any selected or synthesized set of data, derived from the underlying information detail. Collections may be implemented as physical entities, where the results of selection, summarization, and so on are saved and stored as a physical database. Or collections may be virtual entities -- data views -- where the same rules of selection, summarization, etc. are applied to a relational database at query-time using stored SQL.

The chief intent behind "standard" collections is to establish shared definitions for certain transformations of data within the enterprise: the calculation of grade-point-average based on hours and honor points, the set-definition of a full-time student or part-time employee, the accepted intersection of faculty data and course data for use in measurement of teaching load, and so on. Shared definitions, and their implementation in a data architecture, benefit the data user by providing commonly needed information, already synthesized and ready-to-use; they benefit the institution by helping assure that all reports and analyses have access to the same interpretation of the underlying detail data.

Moreover, a standard collection, implemented as a physical database, is desirable when some set of summarizations, selections, or aggregations is repeated so often that significant computing resources are being spent, many times over by many different users, executing the same program code. This is especially true of complex and often-used set-selections like: find all students enrolled in the current semester, find all accounts with outstanding balances greater than thirty days, etc. Finally, implementation of a collection as a physical database in the data architecture is simply a practical requirement when a collection is meant to reflect a "snapshot" point-in-time.

Our progress toward formalizing this step has come slowly. Within selected data subject areas Indiana University has had a long history of using standard collections, in particular for point-in-time snapshots (e.g., student census reporting files). Since 1990, with the implementation of relational database technology, we have also started using logical data views as a means of implementing standard collections.

Step 4: Integrating with local data.

The data architecture as representation for enterprise-wide data needs to be seen as an open architecture with respect to local stores of data that exist throughout the organization. These local data can be a primary source for enterprise-wide operational data; they feed the operational information systems of the enterprise. They can also be the final destination for synthesized information as used in decision-support and analysis at the local level. The enterprise cannot pretend to manage data centrally that is really managed locally. The purpose for placing local data within the architecture is to show the points of interface and to identify the need for these to be managed.

As *source* for enterprise-wide operational data, the key requirement for interface to local operational data is that these data be passed through steps of validation and authentication as prerequisite for their acceptance as enterprise-wide data. As *final destination* for data, the key requirements are to encourage use of standard collections as the basis for building local collections (i.e., encourage use of shared definitions, where such exist) and, if this cannot meet the local need, to assure that information detail (and not operational data) is used to populate local collections.

Open Systems

In light of its mission and strategic initiatives, University Computing at Indiana University has chosen an "open systems" approach as the best possible environment for deploying information technology. In the environment we are developing, five key points are used to define "open systems." First, the technology must be standards-based, whether these are national or international standards, such as are sanctioned by ANSI and ISO, or whether they are defacto standards based on industry acceptance and widespread use. Second, the technology must support a multi-vendor environment, providing interoperability between platforms and, in some cases, portability of applications across platforms. Third, the open systems environment must make use of available technologies, those that are on the market and generally available. Fourth, the technologies chosen should show signs of being sustainable over time within the industry as evidenced by such factors as market share, degree of penetration, vendor viability, and vendor commitment. Finally, the technologies should be oriented to the workstation, enabling the integration of information at the desktop. Indiana has committed to support a heterogenous (multi-vendor) desktop environment and selections of open systems technologies must support this with a user interface that is native to each of the supported desktop devices.

By way of quick comparison, two published definitions of "open systems," both of which provided some basis for our own:

> From Hewlett Packard: "Software environments consisting of products and technologies which are designed and implemented in accordance with standards - established and defacto - that are vendor independent and commonly available." (5)
>
> And from Gartner Group: "An information processing environment based upon application programming interfaces and communication protocol standards which transcend any one vendor and have significant enough vendor product investment to assure both multiple platform availability and industry sustainability." (6)

Examples of Open Systems Technologies

Three technologies, from three different technology families, can illustrate how the definition of open systems can be applied. Not every technology can score highly on every factor, but each of these three technologies is among the best in its class for meeting the criteria of an open systems environment.

In the area of networking, TCP/IP is a good example of an open systems technology. It is a defacto industry standard, is based on available technology, and supports the implementation of interoperability among multiple technology platforms.

In the area of relational databases, DB2 is a key player in an open systems solution. The product is based on the Structured Query Language (SQL) standard; it is an available and robust technology; and it is a sustainable technology based on IBM's investment and direction. In addition, DB2 is a platform to support interoperability (often based on third-party vendor products) because of it's large market share.

In the area of local area networks, Novell is a piece of the open systems picture. It is a defacto standard for network operating systems; it shows very good signs of being a sustainable technology in the market place; and it offers interoperability among technology platforms and some degree of portability.

Because of their intrinsic merits, their fit with an open systems architecture, and based on other decision criteria, each of these three products was chosen by Indiana University as part of its overall open systems environment.

Strategy for Open Systems: Technology Coexistence

The strategy that Indiana University is pursuing for implementing its open systems environment is one best described as "technology coexistence," and is based on just a few guiding principles. Chief among these is that *the network is the key* to deploying open systems. It is the integrating and communicating force in the environment, providing access to multiple services and routing multiple protocols in support of these services.

A second principle is *concentration on the user view* of the technology: each workstation performs multiple functions in our view of an open systems environment; the functions are performed with an interface that is native to the users desktop device; and the desktop represents the integration point for services to the user.

Migration of data to relational database format is a third principle. In order for a coexistence strategy to work -- to enable gateway and network access to data across multiple technology platforms -- a common relational format for the university's data is a requirement. And a related principle is the *deployment of gateway technology* that links proprietary systems with the open systems environment. Especially as pertains to IBM's role in an open systems picture, gateways are the path to more open communication with MVS-ESA (the operating system of our largest central server mainframe); they also permit us to take advantage of DB2 as a database engine and its outstanding ability to manage and serve large volumes of data.

A final principle, which encapsulates much of the rest, is that a *mix of proprietary and non-proprietary technologies* is required for a successful open systems environment. This is the heart of the coexistence strategy. It builds on current strengths, it leverages past investments without being bound by them, it makes use of available or obtainable skills, and it tries not to induce trauma while introducing change to the organization. In particular, it tries to protect user investment in technology (the purchase of desktop devices, design and implementation of traditional information systems, training in tools of information access and analysis, etc.), again while trying not to shackle the computing organization to unlimited and open-ended support of all conceivable technologies.

Three Other Open Systems Strategies

Technology coexistence is not the only path to an open systems solution. Two other strategies outlined in work by the Gartner Group (though carrying slightly different names) are: "Freeze and Rebuild" and "Clearcut and Reseed."

Freeze and Rebuild (also called Fade In, Fade Out) is a fairly flexible transition strategy, at least in terms of the pace at which it is implemented. All information systems and applications based on "old" technologies are frozen; no new investment is made in their maintenance or enhancement. All new investment is made in applications based entirely on open systems technologies. This strategy works best in situations where there are a full suite of well-defined open standards and a clear direction toward their implementation. The strategy does carry with it a relatively high cost, both in terms of lost opportunities, as legacy systems fail to change with the changing needs of their users, and in terms of resource outlay for redevelopment of a completely new set of enterprise applications.

The second transition strategy, *Clearcut and Reseed*, is the most extreme. The plug is pulled on the old system and the new technology is rolled in. One day there are legacy systems and the next day, nothing but open systems. This strategy can work at the level of an individual application or closely related set of applications, or in a small and relatively simple organization. But it is very expensive, and probably impractical, to think about as a viable alternative for the revolution of technology on an enterprise-wide basis.

A third strategy is to simply *Wait and See*. If open systems are not well enough defined (if the problem with standards is that you have too many to pick from), just wait until the picture clarifies itself. In truth, this strategy may not be as safe as it sounds. One of the benefits in an open systems environment is the leverage it provides in negotiation with hardware and software vendors; even with some proprietary components, there are choices and alternate paths to almost any implementation. This leverage is lost to an enterprise that is not pursuing some type of multi-vendor approach to open systems. Moreover, the organization that waits too long may end up being forced into open systems anyway, at a time and pace not of its own choosing, and will ultimately be forced to play catch-up.

Technology Suite at Indiana University

In establishing its open systems strategy of coexistence, Indiana University has selected and deployed products and technologies at four levels: the workstation, the network, the central server, and the database management system. Figure 2 shows the mix of these technologies and their interrelationships.

At the workstation level, Indiana is committed to supporting a heterogeneous mix of desktop computers. Machines running DOS or Windows 3.x are the most prevalent systems on our campuses. There is also a strong Macintosh presence on more than one of our campuses, and the last two years have seen a growing base of Unix workstations deployed as individual desktop devices.

Indiana University operates a high-speed data network among its eight campuses and has promoted the deployment on each campus of a high-speed intra-campus network. The network carries multiple protocols, most significant among them: TCP/IP, IPX, and Appletalk.

At the level of central servers, Indiana operates a large scale MVS/ESA processor which, although proprietary in nature, does support TCP/IP access using Interlink Access MVS. The university maintains and is deploying more VMS and Unix platforms as application and data servers. VMS offers a slightly more "open" architecture than does MVS in terms of interoperability and portability, while retaining several of its key advantages such as structured operations and security management. Unix servers are making great progress in security, operations and performance and will play an increasing role, though they are not seen as an absolute prerequisite or requirement for an open systems implementation. Finally, Novell is a critical component today as a network file server, and as we watch developments in the arena of Novell/SQL database technology we remain aware of its possibilities as a database server.

Regarding central server database technology, our basic investments today are in Ingres as the relational database on the VMS and Unix platforms, and in DB2 as the relational database on the MVS platform, with continued support for VSAM as a data storage and access technology where needed.

Mapping Technologies to the Data Architecture

In its evaluation and selection of technologies for its open systems future, and especially as regards the use of technology to support a data architecture, Indiana University faces questions at three levels of specificity:

1. What will be the suite of technologies we support, and how will we choose them?
2. How will we select one (or more) of these technologies to deploy for one of the functions within the data architecture? (Example: What database(s) will be supported for enterprise-wide operational information systems? Or, what technology might be recommended for local data collections?)
3. And finally, how will select from among the chosen and supported technologies (assuming more than one is supported for any general function) the correct technology for a specific application?

We have made good progress on questions at the first two levels of specificity. A suite of technologies has been chosen for most key technology families: networks, central server databases, etc. As each technology is chosen (Question 1) it is also evaluated and slotted for deployment in one or more of the general data architecture functions (Question 2). The criteria we have used to select and assign a technology include the basic criteria for any technology in an open systems environment: 1) standards based; 2) workstation oriented; 3) supports a multi-vendor environment; 4) based on available technologies; and 5) based on sustainable technologies. In addition, we have applied criteria related to resources and constraints: 1) user needs and functionality; 2) performance and cost; 3) established expertise within the organization, or its availability; 4) degree of integration with existing technologies required, and the degree actually possible; and 5) user preference.

One of the next critical steps, as mentioned below, is our need to develop better decision rules for the selection from among available technologies, where more than one technology is deployed in support of a single data architecture function.

In the area of database technology, Figure 3 shows how DBMS products have been mapped to each component of the data architecture:

Operational Data ==> DB2, Ingres, and VSAM
Information Detail ==> DB2 and Ingres
Standard Collections ==> Ingres, DB2 (and data views)
Local/Operational ==> Ingres, Paradox, FoxPro, etc.
Local Collections ==> Lotus, Excel, etc.

Next Critical Events

The data architecture and the open systems environment continue to evolve in their implementations at Indiana University. Some next critical events in the evolution of data architecture are summarized as follows. Information Detail data needs to continue its migration from sequential and hierarchical file formats to relational format. A methodology is needed for specification and creation of Standard Collections -- how they are defined, by whom, and at what stage of an information systems lifecycle. Decision-rules are needed to select from among available technologies, when more than one exists within any component of the data architecture. User access to data needs to move from a mode of terminal login to central servers to a mode of desktop delivery and integration. And, finally, the preferred source of data needs to move from the detail level to the collections, where significant synthesis will have already occurred and where shared definitions are accessible.

There are similar critical events in the evolution of an open systems environment. Developments in Novell/SQL database technology need to be tracked and evaluated; even if no central support for a single technology is envisioned, integration with user-selected technologies in this field will almost certainly be a requirement of our environment. Technologies for gateway access to and from the MVS world will also continue to be evaluated, both Remote Procedure Call (RPC) gateways for predictable and static interactions between platforms and dynamic SQL gateways for data interaction and interchange. A key goal for the next year or so will be analysis and resolution of issues related to security in a client/server implementation. And, finally, we will need to monitor and seek opportunities for the integration of "standard" Distributed Computing Environment (DCE) functions in our open systems environment: time servers, name servers, authentication servers, and so on.

Notes

(1) W. H. Inmon, *Data Architecture: The Information Paradigm* (Wellesley, MA: QED Information Sciences, Inc., 1989)
(2) W. H. Inmon, *What Is A Data Warehouse?* (Sunnyvale, CA: Prism Solutions, Inc., 1992)
(3) IBM Corporation, *An Introduction to IBM's Information Warehouse Framework* (Corporate Presentation Material, 1991)
(4) Apple Computer, Inc., *Introduction to VITAL: Designing Information Systems for the 1990s* (Corporate Publication, 1992)
(5) Hewlett-Packard Company, *Open Systems Concepts and Capabilities Seminar: Student Workbook* (Corporate Publication, 1992)
(6) Gartner Group, *Open Systems: Cutting Through the Confusion* (Conference Material, 1991)

Figure 1: Data Architecture Model

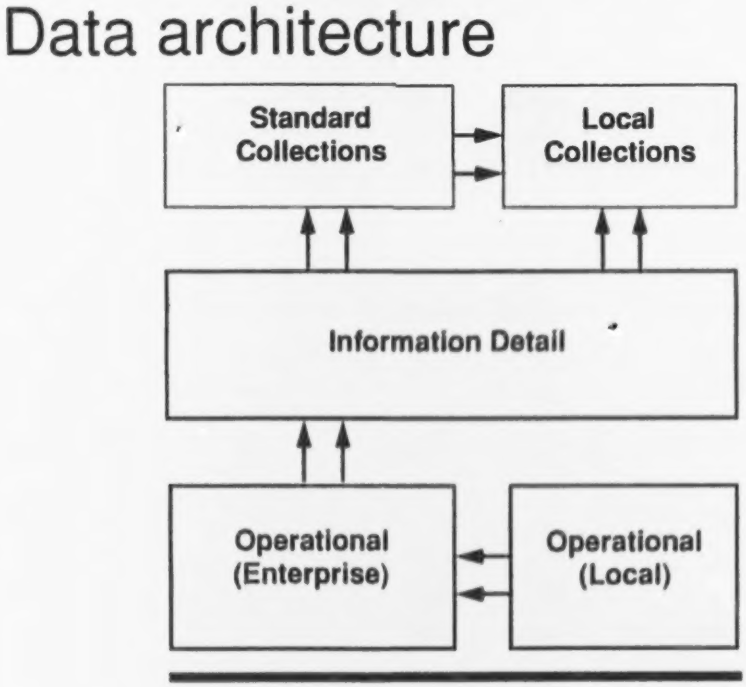

Data architecture
Standard Collections
Local Collections
Information Detail
Operational (Enterprise)
Operational (Local)

Figure 2: Technology Suite at Indiana University

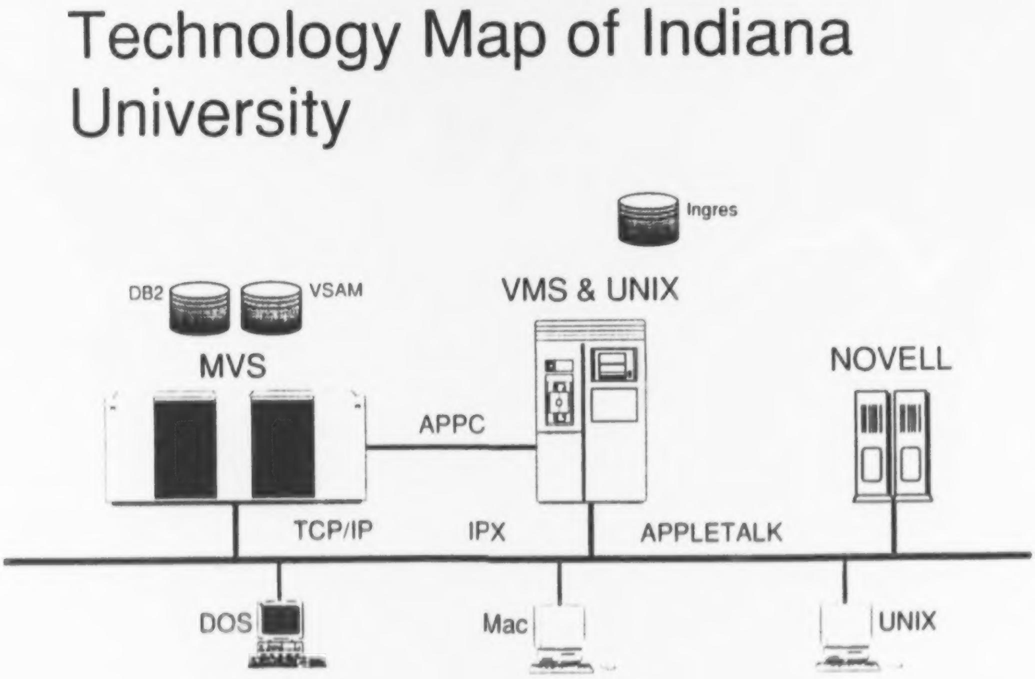
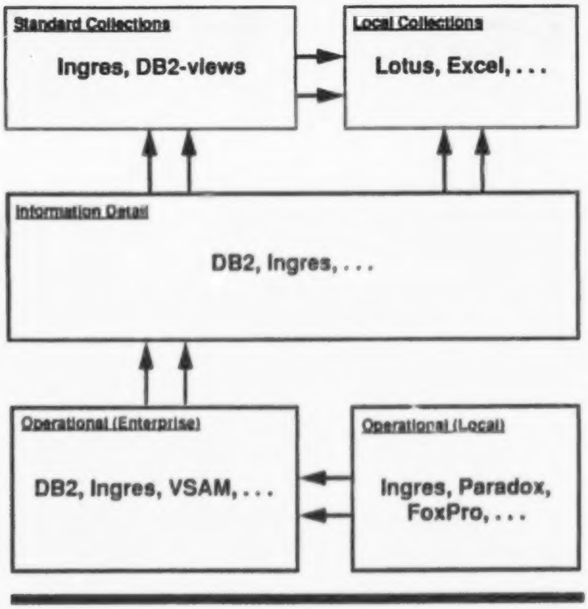

Technology Map of Indiana University
Ingres
DB2
VSAM
VMS & UNIX
MVS
NOVELL
APPC
TCP/IP
IPX
APPLETALK
DOS
Mac
UNIX

Figure 3: Mapping Data Technologies to the Architecture

Data Architecture/Technology Map


Standard Collections
Ingres, DB2-views
Local Collections
Lotus, Excel, . . .
Information Detail
DB2, Ingres, . . .
Operational (Enterprise)
DB2, Ingres, VSAM, . . .
Operational (Local)
Ingres, Paradox, FoxPro, . . .

Managing Data Means Managing Mayhem: the Cultural Revolution Required for Data Administration

by

Roger Lurie
John Rome
John Wasileski

Arizona State University
Tempe, Arizona

Increasing pressure to gain access to university information is being met by the resistence of old cultural habits. To achieve quality in an increasingly competitive environment, we must foster a revolution aimed at transforming old taboos. The new culture must be supportive of data sharing and information systems as opposed to computer systems. This paper documents the steps being taken at Arizona State University to encourage and enable this transformation.

Managing Data Means Managing Mayhem: the Cultural Revolution Required for Data Administration

The Problem and its cause

"Our data are incarcerated in our systems." was one of the many references to data problems stated by the Arizona State University (ASU) community in the documents provided to applicants for the position of University Data Administrator. The quotation expresses, perhaps better than any other phrase, the utter frustration in obtaining reliable data which was felt by everyone on campus. The Office of the Provost had "...no confidence in anybody's numbers..." since everyone claimed to be drawing their information from the same source but, somehow, the numbers wouldn't agree.

This situation came to be because, over the years, much time, effort and money were expended creating very sophisticated *transaction systems* but very few resources were devoted to designing the **information content** for those systems. This is not intended to diminish what the designers had accomplished for ASU, they had done a very good job in integrating many of their systems from a process view-point. Rather, it is intended to provide a context within which to see that methodologies used to build systems have not included enough resources to design *information* as opposed to *process*. As was observed in "DSS - A Promising Future"[1] we simply fit things to the wrong model of management needs.

One Approach to a Solution

In recent years, many businesses and some educational institutions have begun to recognize that a more *information oriented* approach to systems design is required if we are to solve these continually nagging problems. Some organizations, ASU included, established a *data administration* function whose purpose is to help the organization express and gain control of their informational needs. Originally, these offices were "..techno-clerical; charged with trying to capture and manage data elements as they fell out of applications."[2] Later, as the need for integrated information planning was recognized, data administration became responsible for data models and, subsequently, the data warehouse.[3]

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[1] J. I. Penrod and J. S. Wasileski, "DSS - A Promising Future", CAUSE/EFFECT, January 1985, pp. 12-17.

[2] William H. Inmon, "A brief history of data administration's amazing growth and development", Database Programming and Design, January 1992, pp. 68-69.

After having struggled for several years with the concept, ASU's administration established the office of Data Administration in the summer of 1990. The position reported to the Assistant Vice President for Information Resources Management and its first task was to establish a mission for the office and agree upon first year objectives (please see Attachment A for a list of the objectives.) It is useful to consider the mission statement in light of the *'incarceration'* quote above.

Arizona State University
Data Administration Mission

Data Administration seeks to provide more people more access to more information more easily.

This succinct statement has been very much an enabling key for ASU's office of Data Administration. In pursuit of our mission, we established the objectives detailed in Attachment A and set about trying to accomplish them. Briefly, the goals state that community support will be nurtured in building a shared information architecture which will include a single data dictionary and a single logical model of ASU's administrative data.

Easy to say ... not so easy to do at ASU and, we think, not easy to do anywhere. The fundamental fact is that the culture of any organization is both enabling and growth-limiting. In short, the very habits which are endorsed by an organization also prevent necessary transformations within the organization. Bureaucracy is a specific cultural form which generates a *malaise of spirit akin to inertia* and, as Toffler noted, once a bureaucratic structure is in place, it resists change of any kind.[4] Bureaucracy is, however, just one of several possible cultures which became accepted as a form of authority during the industrial revolution and was encouraged by military personnel hired into business management positions following the war. Part of the difficulty in changing a culture is that each one establishes mores which are frequently not expressed directly.[5] Many times these become cultural habits which are so ingrained they take the form of a natural law or a religious belief. We have found the following unspoken beliefs on our campus; perhaps they will also be familiar to the reader.

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[3] Ibid.

[4] Alvin Toffler, PowerShift, Bantam Books, New York, November 1990.

[5] Ibid.

Sacred Cows of The Current Culture

- Each office which collects data owns the data and can decide unilaterally what to do with it, e.g. change the code structure or meaning on its own.
- We've always done it this way. We have a methodology all worked out and there is no need to change it.
- The Buckley amendment forbids data access and sharing except for really exceptional cases. This is the true meaning of security.
- Transaction processing is the most important part of the business and therefore the most important service we can provide.
- Big central machines are the only way to handle the kind of load we have.
- Systems are designed to meet the specific needs of a client office.
- Programmers can create data elements as they need them.
- Only specialists need that sort of capability (information access, etc.).
- The important things are the screens the user sees.
- Executive information and decision support systems are for upper management only.

Many of these "laws" are diametrically opposed to the goals set by data administration. Following them has been quite costly for organizations.

A Recipe for Mayhem

Whenever offices "own" data they tend to make changes to fit their own needs without considering what ripple effects their changes might have. At one university, a simple code addition to "Ethnic Code" forced more than thirty programming changes in their institutional research office before regularly scheduled reporting could be continued. Central computing organizations cling to old development methods. They claim that queries are too hard to manage on a platform which supports heavy transaction processing and, since "big machines" are the only way to go and "the backlog is so big", information oriented designs will simply have to wait. Add to this the confusion caused by the redundancy created when programmers 'invent' data elements "on the fly", stir in a good measure of not sharing data in the name of security and you have the makings of a first-rate **informational mayhem soufflé**. You can recognize when the mixture is ready by the following signs:

What the Sacred Cows Cause

- Faculty, researchers, and staff are hindered in their work by the daunting process of just getting to needed data.
- Systems lack the flexibility to adapt to change.
- Staff create independent, incompatible systems and abandon the "corporate" systems to meet their informational needs.
- The organization speaks "datababble" (confused mutterings about data, their meanings and uses) which leads to incorrect conclusions.
- Management cannot get timely information.

It seems clear that, if data administration is to succeed, one of its fundamental jobs must be to help move the organization to a new set of cultural beliefs - beliefs which are more supportive of data sharing.

How to Change a Culture

What ASU's Office of Data Administration did:

- Created policies to guide change.
- Created a dictionary to foster common understanding.
- Provided a solution to the problem of access to data.

ASU's office of Data Administration decided on a frontal attack of these problems. We worked within the advisory committee structure to *formulate policies for change* and simultaneously began working to provide *easy access to and a basic understanding of the data.* DASC (Data Administration Subcommittee) was formed as an advisory group composed of members of an already existing Administrative Computing Advisory Committee (AdCAC). DASC helped formulate three major policy statements dealing with the fundamental issues of how ASU would address its information environment. The full text of these can be found as Attachment B but the "policy" portion of them is easily summarized.

The **Data Access Policy** provides open access to most university information for all faculty and staff in support of university functions. It also provides for restrictions of certain data elements and a process for appealing restrictions.

The **Data Integrity Policy** establishes a single logical model for university data and requires that each data element be documented in a single, universal dictionary.

Finally, the **Data Usage Policy** specifies "update", "read only", and "external dissemination" of information as three separate categories of usage and gives guidelines for the use of data in each of these. It pays special attention to data which are downloaded and requires both the dictionary value and meaning of elements be preserved.

When finally approved, these policies will provide for a sweeping reform of our current practices. The policy on Data Access has been approved by ITAC[6] (Information Technology Advisory Committee) and sent to the Provost. The other two policies are pending action by ITAC. The process has taken nearly two years thus far, has been intricate, and provides clear evidence of the slow motion bureaucratic systems apply to change.

Proof of Concept

Policies by themselves are insufficient to change established habits. However, policies coupled with actions demonstrating the requirement for the policies while providing needed services can be a powerful combination for cultural change. The policies were being moved through channels, we needed the actions. The actions were initiated through two projects we thought would provide the *needed service* and focus attention on the need for policies which would fuel a change within the university.

The first project was to build a meaningful data dictionary, first as a document and then as an integrated part of our systems. Attachment C shows an example of the work done on each data element while the frame below summarizes the metadata we decided were needed in our environment.

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[6] Formerly ICSAC (Information & Communication Systems Advisory Committee).

Arizona State University
Metadata for
Data Element Dictionary

Element ID Number
Definition
Domain
Length
Derived Element/Algorithm
Alias names
Form(s) Id(s)
Registration Date
Origination office(s)
Purpose
Field description
Release Flag
Language Names
Screen(s) Id(s)
Element Name
Update office(s)
Usage notes
Group element/Name
Retirement Date
Trustee
Report(s) Id(s)

Note that the metadata are not fixed, our dictionary is completely flexible and can be adjusted to suit changing needs. For example, we have decided to include new metadata to capture information on the Warehouse (see below) location of elements. It took about six months to complete the definitions (i.e. gather the metadata values) for about 1,000 elements within the student system. The initial version was released near Christmas in a large red three-ring binder. It is affectionately called "Big Red" by those who contributed to it and use it. Though it is now available in a much more convenient form, Big Red is the reference document of choice for definitions and domain values. The Dictionary Project (which is really an on-going process) served two purposes: first, it helped get people within the campus involved (about 20 people, representing all academic and administrative units, formed a Dictionary Task Force for general review with the bulk of work being done by a much smaller subgroup). Second, it helped data administration begin to understand the intricacies of ASU's data. One side-effect was that it "made some noise" on campus and helped focus attention on the larger tasks Data Administration would be undertaking.

Our next major project was the design and construction of a Data Warehouse. Following Inmon's[7] ideas that a Data Warehouse is a:

- subject oriented
- integrated
- time variant
- non volatile

collection of data in support of management's decision making, Data Administration used DEFT, a CASE tool, to design a relational database model of the Student Information System (SIS) optimized for querying. A graphical representation of this model is included as Attachment D.

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[7] William H. Inmon, "What is a Data Warehouse", Tech Topic vol.1 No. 2, Prism Solutions, Inc., 1992.

The design team was lead by John Rome from Data Administration and consisted of eleven staff members from Information Technology. The analysis stage was guided by over two hundred questions which client offices provided as difficult to answer under current conditions. Information gathered during the analysis stage demonstrated a need for historical data to provide for longitudinal studies.

The Warehouse is populated via extracts from the corporate transactional files and designed to allow for modifications as we learn more about the informational needs of our campus. We can confirm what was observed in "Implementing the Data Warehouse"[8], ... maintenance of a warehouse via extraction and update is a constantly changing process. Historical data are frozen in the data warehouse and the current version provides ten years of history.

Implemented in a client/server architecture which uses Sybase on a SUN 630, warehouse client tools like Brio's Data Prism and Data Pivot afford a graphical user interface which is very easy to learn. Many client tools were evaluated in-depth by the project team for the PC/Windows and Macintosh environments. This exploration and evaluation exposed a number of software tools that were in an adolescent state and not ready for delivery to the average end user. We have found Brio Technology's tools very helpful in providing meaningful access to data with minimal training.

The project took 116 days from initiation to completion and was announced to the ASU community through an all day open house called "Data Access - A Piece of Cake". Visitors were welcome to eat cake and 'kick the tires' on more than a dozen client tools which we had explored and evaluated[9]. Approximately 250 of the universities faculty and staff attended.

The demand for access to reliable data has mushroomed since the implementation of the Data Warehouse project. Requests have come from many university departments including college deans and the Office of the Provost. In one instance, a department was a finalist for a $2 million grant award. The award was contingent upon the availability of data on minority enrollment in the department's programs. After having tried all other possible sources, a very frustrated staff member called to see if the Warehouse might be of some help. Because of its ease of use, an administrative assistant from the department was given brief training and was able to obtain all of the reports needed to meet the criteria for grant approval in less than half a day.

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[8] C. Sue Herman, "Implementing the Data Warehouse", Data Base Newsletter, vol.20 No. 5, Database Research Group, Inc., September/October, 1992.

[9] Roger Lurie, "Arizona State University Data Warehouse Client Tool Evaluation Report", Arizona State University, Data Administration, October, 1992.

We are currently arranging for the Data Warehouse to become a production system which will be expanded to include Human Resources and Financial information all incorporated into the same relational design. The target date for completion is June, 1993.

Conclusions

Tangible results rather than rhetoric are required to change the culture of an organization. These projects have had substantial effects in that direction. Offices with decentralized, unintegrated systems have initiated discussions to move their data into a warehouse-like environment for sharing. They have also agreed to supply the required metadata for their elements to the dictionary. The flood gates seem to have opened for questions which could not be previously asked. Questions are getting more complicated and are indicating design changes for the warehouse. People now know where the office of Data Administration is located on campus and, perhaps most telling, under conditions of severe budget limitations, the warehouse project has been approved for implementation.

Attachment A

Arizona State University
Information Resources Management
Data Administration
Objectives for 1990-1991

1. Establish Groups for Coordination and Consensus

a. Develop an advisory group(s) for Data Administration policy development.

b. Establish a project team to begin planning for an ASU Data Architecture.

c. Begin developing positions for data administration staff.

2. Identify Issues Requiring Policy Development

a. Identify the issues which require data management policies.

b. Prioritize the issues identified above.

c. Draft policies for the prioritized issues.

3. Begin the development of ASU's Master Plan for Data

a. Conduct a study to discover the hindrances experienced by campus personnel in their efforts to produce information required in their decision making and take steps to ensure that such hindrances are removed as part of the data administration effort.

b. Build consensus on what constitutes a data architecture for ASU.
[What is in the "Table of Contents"? What do the diagrams look like?]

c. Design the format and metadata content for an ASU Data Dictionary.

d. Establish a process for data element review and definition.

e. Establish standards for data names, capture, encoding, etc.

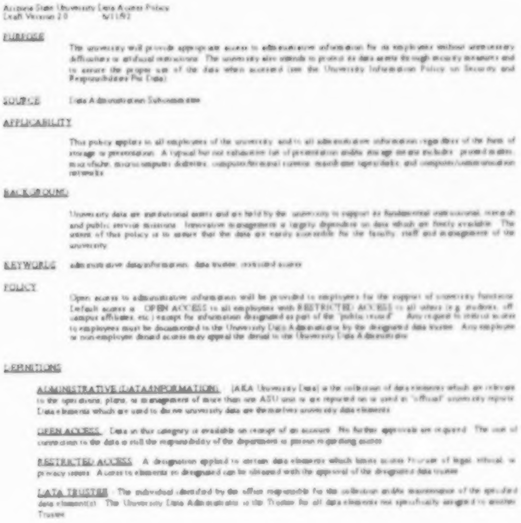
f. Make significant contributions to defining and planning the ASU administrative systems infrastructure.

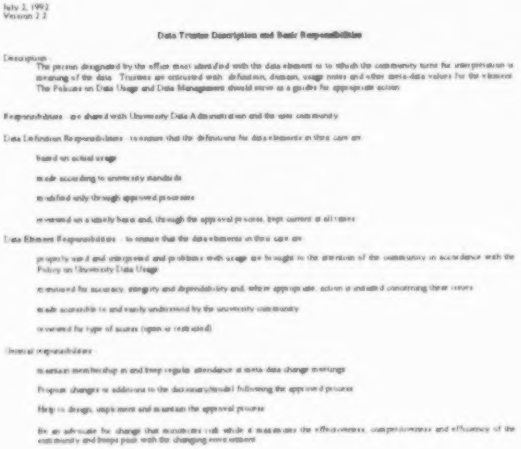
4. Identify the Key Systems needed for Data Administration

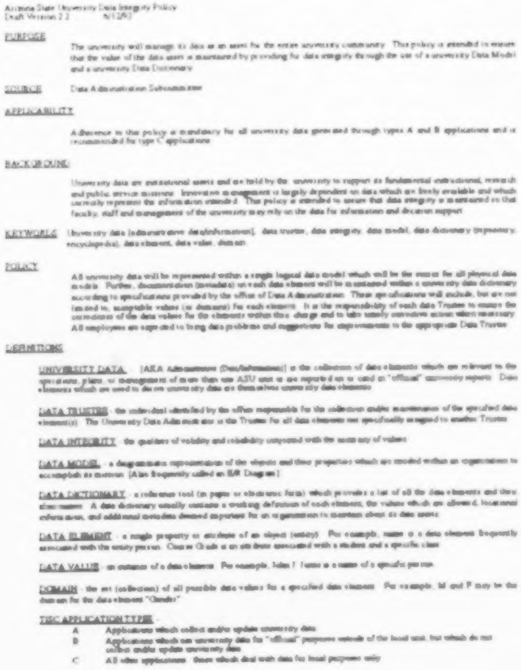
a. Create a combined listing of all data elements used within "administrative" system files.

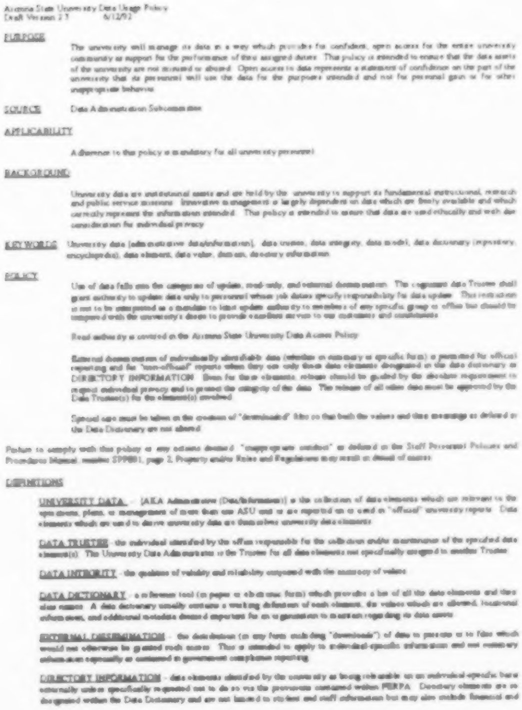
b. Identify a data dictionary product and begin planning its implementation.

Attachment B









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Attachment C

ASU **DATA DICTIONARY**
Data Administration

Element ID: SIS-00005 **Registration Date:** 07/24/1991

Element Name: ASU ID

Definition:
A unique nine position numerical character code used as an identifier for persons, businesses, or other entities formally or officially affiliated with ASU. The customary entry for person is Social Security Number but the system will assign an arbitrary ID if such a unique identifier is not available at the time of record creation.

Originated by: Undergraduate Admissions/Graduate Admissions/Law Admissions/Residence Life/Registrar/Human Resources/Parking/System

Updated by: Registrar/System/Undergraduate Admissions/Graduate Admissions/Law Admissions/Financial Aid/Parking

Domain:
Any nine position numerical character field as in XXXXXXXXX with the X's being any one of {0,1,2,3,4,5,6,7,8,9}

Purpose:
A unique identifier for system records and the affiliates associated with them

Notes:
See the Alumni ID which is not the same though the Alumni files contain this field as SSN. SSN is also used in some systems in addition to ASU ID so one cannot conclude that this element is the same as Social Security Number. System creates ID when SSN or other identifier is not available.
The admissions offices can assign a new or change an existing ASU ID number if no other records are yet attached to the ID record. If an ID is found to be in error or a student is assigned a new ID (foreign students obtaining citizenship), the student is given a new ASU ID. The old ID is retained as PREV-ID-REC. Refer to element PERSON PREVIOUS ASU ID (SIS-02025)

Length: 9 **Picture:** 9(9)

Group Element: No **Group Name:**

Derived Element: No **Algorithm:**

Retire Date: **Release flag:** No

Alias Names: SSN, Social Security Number

Language Names: ASU-ID, ASU_ID (Focus), see ID (Focus)

Trustee: Registrar

ASU **DATA DICTIONARY**
Data Administration

Element ID: SIS-00005

Element Name: ASU ID

Forms:

Form ID	Form Title	Form Label

Screens:

Screen ID	Screen Title	Screen Label
AD04	UG Admissions (RG)	
AD05	UG Admissions (IN)	
AD06	UG Admissions (AP)	
AD14	Grad Admissions (RG)	
AD15	Grad Admissions (IN)	
AD16	Grad Admissions (AP)	
AD20	Competency Maintenance Screen	
AD30	High School Course Entry Screen	
AD32	High School Course Evaluation Screen	
AD40	Transfer Transcript Entry Screen	
AD42	Transfer Transcript Evaluation	
AD45	Academic Advisement	
ADNA01	Non-Applicant Data File	(SS#)
DB10	ASU-ID/Name Inquiry	
DB10F		
HS01	Student Immunization Screen	
ID01	Student Status Verification	
ID02	Paging Message Inquiry	
ID03	Administrative Hold Maintenance	
RG20	Program of Study Inquiry	
RG23	RG Admissions	
RG24	Curriculum Maintenance	
RG25	CUM Maintenance	
RG26	Transcript Maintenance	
RG36	ASU Registration	
RG37E	ASU Registration Erase	
RG38	Academic Maintenance	
RG51	Student's Classes Inquiry Overrides Delinquencies	
RG54	Official Transcript	
RG54C	Unofficial Transcript	
RG54CB	Unofficial Transcript-Business Option	
RG54L	Unofficial Transcript-Campus Option	
RG60	Placement Test Score Inquiry	
RG61	Placement Course Work Inquiry	
RG70	Admissions Status	
RG81	Student Note Screen	
RGMA01	Mandatory Advising-Enrollment Authorization	
RGPR01	Transcript Request and Permanent Record Card	
RGTT01		

ASU **DATA DICTIONARY**
Data Administration

Reports:

Report ID	Report Title	Report Label
AD2410-02	Readmissions Ready to Evaluate	ASU ID
AD7222-02	Registrar's Office Matched Transcripts	ASU ID
AD7226-01	Transcript Summary Audit Report Requests to Post Courses	ASU ID
AD7226-02	Transcript Summary Audit Report Disconnect Request Report	ASU ID
AD7226-03	Transcript Summary Audit Report Match Requests Report	ASU ID
AD7246-01	Transcript Summary Report Exceptions	ASU ID
AD7252-03	Registrar's Office Course Exceptions	ASU Hours Type
AD7252-03	Registrar's Office Course Exceptions	ASU ID
AD7252-04	Registrar's Office Transcript Exceptions	ASU ID
AD7256-02	Registrar's Office Transcripts Posted	ASU ID
AD9150-01	Readmit Students with Transfer Transcripts Purged for YYT	ASU ID
AD9810-03	Readmissions Purged Non-Applicant Data	ASU ID
AR7010-01	Graduating Students with a Delinquent Account	ASU ID
ID1020-01	Identification and Activity Control System Purged Paging Messages	ASU ID
IS3040-01	Departmental Course Master Selected Class Lists for YYT	ASU ID
IS3040-01	Departmental Course Master Selected Class Lists for YYT	Instructor ID
IS3070-01	Departmental Course Master File Update List for YYT	Instructor ID
RA0150-01	Students Not Meeting University Testing Requirements, No Courses Dropped YYT	ASU ID
RA0150-02	Students Not Meeting University Testing Requirements Enrolled for English or Math YYT	ASU ID
RA0150-03	Students Who Failed Placement Exam YYT	ASU ID
RA0150-04	Ineligible - Exam is Not a Reason YYT	ASU ID
RA0150-11	First Semester International Students Lacking ENG 107 or ENG 108 YYT	ASU ID
RA0310-01	Professional Programs Summary	ASU ID
RA0320-01	Professional Programs Erased Records	ASU ID
RA0360-01	Professional Program Audit Report MM-DD-YY to MM-DD-YY	ASU ID
RA0905-01	Mandatory Advising Compliance Reports Students Who Have Been Advised as of MM/DD/YY for YY/T	ASU ID
RA0931-01	Enrollment Authorization Override Tracking Report by Override Type	Student ASU ID
RA0941-01	Enrollment Authorization Signoff Tracking Report By College for YY/T	Student ASU ID
RG0055-01	Class Detail Errors Out of the Student Master Extract	ASU ID
RG1007-01	Change of Hours for YYT SLN 99999	ASU ID
RG1050-01	Skeleton Proof	Instructor ASU ID
RG2100-01	Error Report	ASU ID

ASU **DATA DICTIONARY**
Data Administration

RG3030-01	Invalid Request Report for YYT	ASU ID
RG3031-02	Mandatory Advising Early Registration Report Students Who Submitted Early Registration	ASU ID
RG3039-01	Privileged Student List Before Scheduling	ASU ID
RG3039-02	Privileged Student List After Scheduling	ASU ID
RG3070-01	Error Report For YYT	ASU ID
RG3130-01	Students Not Graduated with Graduate Curriculum	ASU ID
RG3130-02	Students That Have Had Their Curr Recs Adjusted	ASU ID
RG3130-04	Students with Invalid Curriculum Records	ASU ID
RG3140-01	Preregistered Law Students	ASU ID
RG3145-01	Disenrolled Students	ASU ID
RG3300-01	Errors Report	ASU ID
RG3308-01	Class Scheduling Error Report for YY/T	ASU ID
RG3420-04	Class Roster for YY/T First Day of Classes	ASU ID
RG3585-01	Board of Regents Error Report	ASU ID
RG4010-01	Class Roster and Grade Record For YY/T Mid Terms	ASU ID
RG4020-01	Grade Error Report Finals	ASU ID
RG4030-01	Error Report	ASU ID
RG4050-01	Missing Grade Report	ASU ID
RG4210-01	Probation Report for YY/T	ASU ID
RG4520-02	Student Records Database Auditor by ASU ID within Error Code	ASU ID
RG4710-01	Archiving Errors Report	ASU ID
RG4820-01	Incomplete Grade Changes for YY/T	ASU ID
RG5240-02	Transcript Request System Daily Production Report Printed Transcripts	ASU ID
RG5240-03	Transcript Request System Daily Production Report Electronic Transcripts	ASU ID
RG5240-04	Transcript Exception Report Daily Production Report	ASU ID
RG5282-01	Transcript Request System Daily change Report	ASU ID
RG5503-01	ASU Foreign Students in YY/T	ASU ID
RG5518-01	Undergraduate Overload Report for YY/T as of MM/DD/YY	ASU ID
RG5532-01	Vet Count Report for YY/T	ASU ID
RG5534-01	Veterans Registration Report for YY/T	ASU ID
RG5534-03	Veteran's Roster by College as of MM/DD/YY	ASU ID
RG5536-01	Athlete Registration Report for YY/T	ASU ID
RG5540-01	Graduate Student Overload Enrollment Error Report	ASU ID
RG6110-02	Athletes with Hours After Their Class Adjustment for Semester	ASU ID
RG6110-03	Veteran Students with Hours After Their Class Adjustment for Semester	ASU ID
RG8830-01	Students Admitted and Enrolled for YY/T Needing Disenrolling	ASU ID
RG8860-01	Competencies Met Status Change Report for YY/T	ASU ID
RG8880-01	Competencies Met With ASU Work for YY/T	ASU ID
RG8880-02	Competencies Met Exception Report In End Evaluation Semester Order for YY/T	ASU ID
RH0110-01	Yearbook Request Report Students Registering for YY/T	ASU ID
RM0050-01	Course Master Conversion Error Report	Instructor ASU ID

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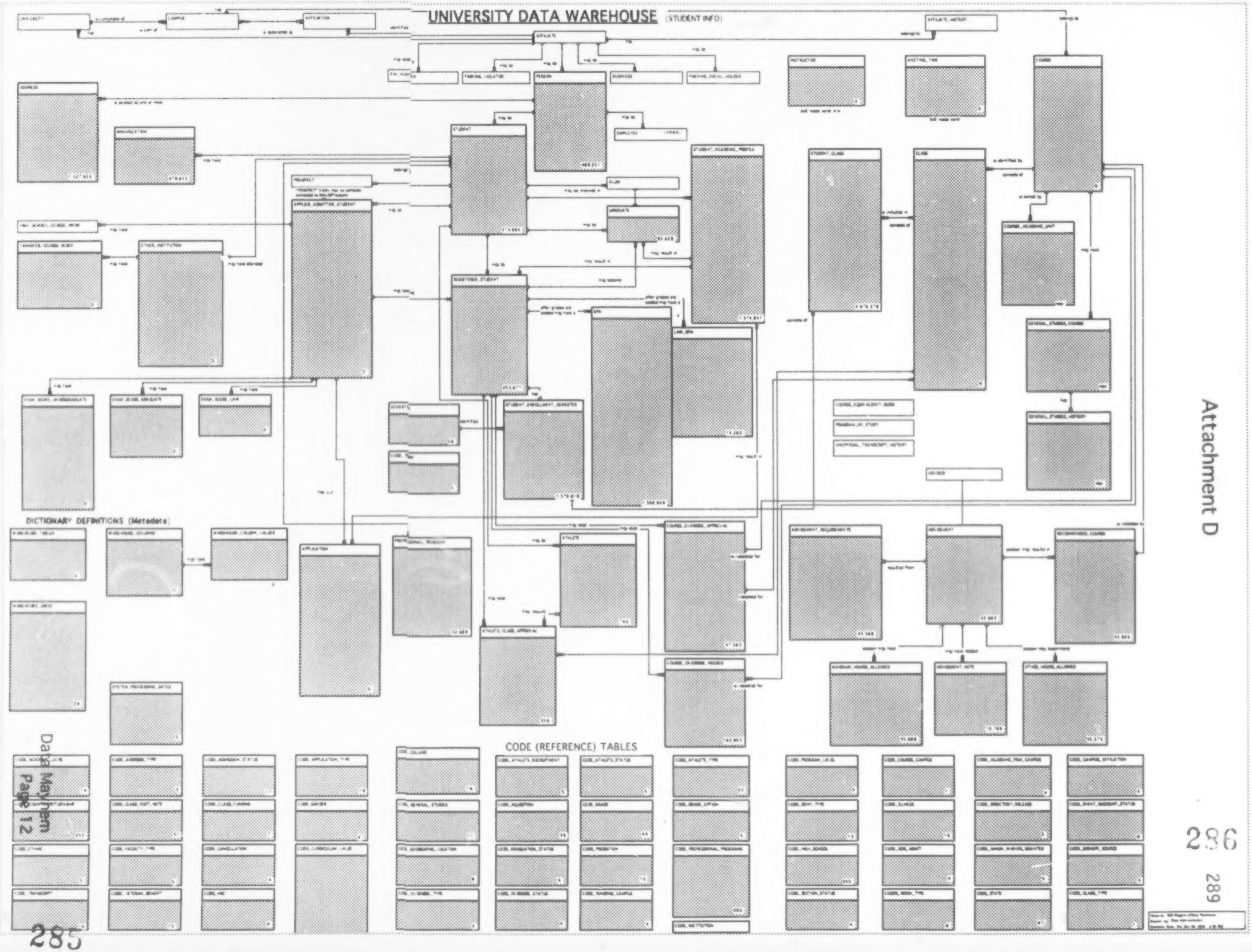
UNIVERSITY DATA WAREHOUSE
(STUDENT INFO)
UNIVERSITY
CAMPUS
AFFILIATION
AFFILIATE
AFFILIATE_HISTORY
PARKING_VIOLATOR
PERSON
BUSINESS
EMPLOYEE
ADDRESS
STUDENT
PROSPECT
APPLIED_ADMITTED_STUDENT
HIGH_SCHOOL_COURSE_WORK
TRANSFER_COURSE_WORK
OTHER_INSTITUTION
REGISTERED_STUDENT
GPA
INSTRUCTOR
MEETING_TIME
COURSE
STUDENT_ACADEMIC_PROFILE
STUDENT_CLASS
CLASS
COURSE_ACADEMIC_UNIT
GENERAL_STUDIES_COURSE
GENERAL_STUDIES_HISTORY
STUDENT_ENROLLMENT_SEMESTER
ATHLETE
ATHLETE_CLASS_APPROVAL
APPLICATION
COURSE_OVERRIDE_APPROVAL
COURSE_OVERRIDE_NEEDED
ADVISEMENT_REQUIREMENTS
ADVISEMENT
ADVISOR
ADVISEMENT_NOTE
DICTIONARY DEFINITIONS (Metadata)
SYSTEM_PROCESSING_DATES
CODE (REFERENCE) TABLES

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Data Mayhem
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FACILITATING CHANGE FOR SURVIVAL

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Higher education is facing significant challenges and will not maintain its leading role in our society unless it adopts a philosophy that promotes change. Information technology organizations have the opportunity to contribute by providing leadership and taking an aggressive approach to finding better ways to do more with less and efficiently utilizing all available resources. Technology alone will not change the way one does business, but it is an enabling tool and offers unlimited opportunities.

University Systems Analysis & Services (USAS) was established in January, 1992, and reports to the Vice President for Information Systems. USAS provides leadership and operates to assist departments at Virginia Tech in facilitating strategic changes for administrative processes and overall operations.

The presentation provides an overview of USAS: its conception, organizational structure, and operating environment. Special emphasis is placed on the re-engineering philosophy and guidelines used by USAS for project definition, analysis, and implementation. The philosophy incorporates re-engineering concepts into the planning process and provides opportunities to significantly impact the way business is conducted in several key administrative areas at Virginia Tech.

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An Era of Change

Economic, political, and social transformations have caused significant changes in higher education during the past decade, and predictions for the 1990s are even more phenomenal. In terms of administrative functions, the escalating cost of higher education will force institutions to do more with less. With the always present concerns about demographic changes, aging physical structures, global competition, operating budgets, quality education, and so on, higher education is in for an arduous decade (Donald, 1990).

Higher education can benefit from the experiences that have transpired in business and industry during the 1980s. Companies began to recognize they had to change business practices if they were to survive in the competitive business world. They also recognized that increasing capital and human resources did not necessarily lead to success. Instead, the focus shifted to addressing issues surrounding service, quality, speed of response, and innovation (Penrod and Dolence, 1991). This focus is evident in today's higher education environment.

Although global changes in higher education are critical, this paper underscores change in administrative areas that would ensure more efficient and effective operations. Implementing an aggressive planning process can aid institutions in discovering new methods for meeting ever-increasing demands for facilitating change. A combination of re-engineering and total quality management concepts can reveal opportunities for meeting the many challenges with advanced and innovative alternatives. Organizational structures are already changing in some institutions to simulate what has been happening in private industry for a number of years, that is, flatter structures with more point-to-point relationships (McIntyre, 1990). However, how institutions plan and organize for change and the implement these concepts are critical factors.

This paper describes the information technology environment at Virginia Tech and the procedures being implemented in administrative processes and systems to meet challenges. The organization has been established specifically to help constituents throughout the institution face the issue of change and to define an environment that will ease the transition to conducting business differently.

A Concept for Facilitating Change

Richard L. Nolan's 1990 CAUSE/EFFECT article focused on the issue of transforming business activities in higher education. Nolen explained "that 'getting it' means understanding what transformation is, what is driving it, and what must be done to transform an organization. Transformation is changing an organization and the principles of managing it in a way that makes the organization viable, productive, and competitive in the information economy of the 1990s and beyond. The state of most organizations today and the way they are being managed will not survive into the 1990s" (Nolan, 1990).

Re-engineering or Total Quality Management

Perhaps one of the precarious questions facing institutions preparing for this transformation is whether to adopt a concept of re-engineering or one of total quality management. Is there really a difference? The strategy adopted at Virginia Tech was influenced by the opinion that both concepts are really one in the same. A 1992 white paper published in InformationWeek states that business re-engineering can be looked at "as a way of jump-starting a total quality management program when we don't have a year to think about it, a year to get ideas, and a three-year outlook to get solutions implemented" (InformationWeek , 1992).

Virginia Tech has incorporated a concept of re-engineering into planning for administrative processes and systems to improve business activities at the university. The concept is geared towards a fresh and objective view of business processes. Virginia Tech is fortunate that senior management supports an approach of "leaving no stone unturned." Re-engineering efforts not only examine business processes at the university, but often analyze policies (both local and state), organization, staffing, and information technology -- all subject to change. The re-engineering effort is, in many ways, "jump-starting" a total quality program that will instill an environment of continuous improvement at Virginia Tech.

A Re-engineering Definition for Virginia Tech

Re-engineering has often been defined as a variation of other processes. Definitions have been associated with such terms as quality processes, industrial engineering, strategic information systems, and business processes such as Process Design Concept (PDC) and High Productivity Program (HPP) (King, 1991; Penrod and Dolence, 1991). However, a CAUSE/EFFECT article included a description of one design that Virginia Tech has incorporated into its plans and educational/awareness programs. The article described re-engineering as a process for

- "reexamining basic assumptions about the way we do things and rejecting those that do not fit the technological capabilities of today;
- redesigning work processes based upon new assumptions;
- and 'thinking out of the box,' that is, refusing to be limited by traditions of the past" (Penrod and Dolence, 1991).

Whether re-engineering is considered a methodology, process, structure, or transformation, its purpose is to help organizations change the way they think about doing things. It provides the opportunity to be aggressive and rapidly produce results, while introducing a total quality process to sustain progress (InformationWeek , 1992).

Implementing a Re-engineering Process

Although few argue against a need for transformation in higher education, implementing a re-engineering process promotes change and involves risks. Keys to successful implementation are management support and strong leadership. In order to gain these, a plan must be in place to "sell" the re-engineering concept to senior management, identify leadership for university efforts, and establish (or re-organize) a unit to implement the plan and provide the initiative. Potential costs for re-engineering are an obvious concern, but Virginia Tech proposes that such a process can, most often, be implemented with existing resources and that benefits will justify any additional costs.

Gaining Support

Donald Langenberg, Chancellor for The University of Maryland System, responded to Nolan's transformation concept by placing it within the framework of a revolution. Langenberg states that "revolutions are not democratic, in the sense that a popular consensus must develop before anything can happen. All it takes is a few dedicated revolutionaries who do 'get it.' Then it will happen" (CAUSE/EFFECT, 1991). Those revolutionaries are leading the effort to incorporate a re-engineering program in the planning processes at Virginia Tech. Penrod and Dolence amplify Langenberg's view by emphasizing that leadership may be the key to a successful re-engineering program (Penrod and Dolence, 1991).

The leaders (or revolutionaries) must provide the initiative to "sell" the re-engineering concept to senior management. This effort is extremely important and involves several important steps.

- The first step in this process is to recognize the need for re-engineering and to convey this need to management -- in fact, the process is enhanced if this information is conveyed to all levels of management. Management needs to understand that most processes in use today were never thoroughly analyzed or thoughtfully designed. Many present processes arre results of automating an existing manual process (Davenport and Short, 1990).

- Another important step is to communicate a vision. Part of developing a plan for re-engineering is to provide a sense of direction for management. What is it going to buy them? How can it benefit the institution as a whole? In some cases, the re-engineering concept may reach beyond administrative areas, and other individuals must have an understanding of what this "revolution" will bring to their areas. Keep explanations simple, but put something out on that horizon.

- Management must understand its role in this type of endeavor. The re-engineering concept must be "publicly" endorsed. The concept is not one that should be viewed as a crusade for any specific group; it must take a top-down approach, and visible management support is essential (Alter, 1990).

- A more horizontal approach to planning for the institution is also necessary if this type of effort is to succeed. Nolan refers to information technology as shifting from a spectator sport to a participatory sport for senior management. Information technology planning must be an integral part of the institutional planning process that includes a vision and a sense of how information technology can complement the institutional mission and goals (CAUSE/EFFECT, 1991). Information technology leaders must become part of the team and contribute to overall institutional planning.

- Finally, management must comply with putting an organizational structure in place that can be a facilitating and enabling force in the re-engineering effort. Any such organization will be impacted by current structures, but the plan needs to include a recommended organization that can provide leadership in implementing the re-engineering concept.

The plan and its presentation to management must be persuasive. The design must address major obstacles and present the "newness" of the concept in a way that is not threatening to management. The plan is, indeed, the first step in a lengthy educational process that will reach across the university.

Identifying Leadership

Defining an organization to facilitate the re-engineering concept requires careful evaluation of what needs to be accomplished, who can get the job done, and where the organization should be placed within the university structure.

Information Systems is in a unique position to provide leadership and facilitate the re-engineering efforts. There are few organizations within a company or university that "have the cross-functional license to poke its nose into other people's business" (InformationWeek , 1992). Once the organizational and re-engineering concepts were approved by senior management, it was clear that information systems professionals should provide the leadership (Alter, 1990) at Virginia Tech because they

- tend to have a greater university-wide perspective of issues;
- are usually experienced in working with management from many areas of the university (can help facilitate cross-functional discussions) (Alter, 1990);
- have a visionary perspective that is useful in looking at transformational issues;
- are accustomed to systemic thinking;
- possess a willingness to challenge the way things are done; and
- understand and recognize the technological opportunities available for new initiatives.

In January, 1992, the Vice President for Information Systems was given the leadership responsibility for the re-engineering efforts. Existing Information Systems resources were used to set up a new department -- University Systems Analysis & Services (USAS) -- reporting directly to the Vice President for Information Systems.

An Organization for Re-engineering

University Systems Analysis & Services is charged with providing direction and leadership for administrative systems and for incorporating a philosophy that integrates re-engineering concepts into the planning process. In the months since its conception, the department has moved rapidly to assemble a staff, define organizational philosophies, implement a different approach to project management, and begin facilitating change at Virginia Tech.

Staffing the USAS Team

Perhaps the most important ingredient in the success of any re-engineering effort is personnel. Staffing USAS for leading the re-engineering projects is not unlike putting together a sports team: you put good players in strategic positions with the necessary role players to make a team that can be successful. The immediate reaction from many organizations is that such people do not exist within the company (or university) and that such personnel may also be unaffordable. Virginia Tech found the right personnel for the tasks among existing resources and has received full support in reallocating several faculty and staff positions. USAS management initially searched within the university (faculty, staff, and even students) to locate individuals who possessed certain skills needed in this undertaking.

Rapid and major change in the work environment is not easily accepted by personnel; however, change is what re-engineering is. Therefore, assembling a critical mass of innovative people who can deal with change and aid others is crucial (Penrod and Dolence, 1991). USAS management at Virginia Tech continues to seek senior personnel who possess the abilities to serve the institution by providing

- vision and innovation in solving problems;
- a bias for action;
- quick identification of waste;
- the ability to think horizontally and across administrative boundaries;
- confidence and maturity to set aside egos and be a team player;
- a knack to "blue sky" and think big;
- an awareness of current technology and future treads;
- understanding of the university mission and processes;
- an ability to anticipate future higher education reaction to trends, threats, and opportunities; and
- an interest in helping Virginia Tech in a most difficult and challenging period (Fax Forum, 1991).

Assembling a staff with these qualities is important and will help create a new responsiveness to university administrative functions and systems.

USAS Operating Philosophies

Deficiencies within the administrative systems environment indicated the need for an organization that would be responsive and provide leadership. Identifying characteristics of such an organization helped define the functions of USAS and expectations for specific groups.

- USAS is only responsive to invitations received from senior management; for major requests, the invitation must initiate with at least the Vice President level.
- Vice Presidential areas are responsible for establishing university priorities from formal invitations. USAS senior management will also maintain an "ongoing" project list.
- USAS stresses a team concept within their structure and on individual projects so people are working together towards a common vision.
- The USAS organization is "project driven" so that available resources can be utilized effectively.
- Each USAS project team consists of quality and aggressive personnel with both diverse and advanced expertises.
- Project guidelines are always accessible to assure consistency in analysis and development of project plans.
- Each project accepted by USAS is approached with an open mind and analyzed with a global perspective. Participation from all those affected by changes is required.
- Rapid development and implementation techniques are used to ensure shorter turnaround for projects accepted by USAS.

- Administrative offices secure and maintain sufficient resources to accept responsibility for production and maintenance after a process and/or system is operational.

Administrative processes at any institution of higher education are opportunities to impact cost, quality, service, and innovation. An organization with these operational philosophies helps Virginia Tech anticipate changes, recognize opportunities, and progress to strengthen the administrative environment.

Strategies for Re-engineering Success

Once an organization has been defined and the staff assembled, a priority must be established for making internal changes. USAS management realized that if its organization was to lead re-engineering efforts, then change had to start at home. Traditional and conventional practices of managing projects would no longer be effective for facilitating change. The old "systems development" practices, policies, methodologies, and operations had to be reviewed for improvement, change, and/or elimination.

Staff Development

A top priority in any re-engineering effort must be in the area of staff development. The USAS staff presented several challenges to its management: (1) technology expertise for the systems personnel, on the average, was limited to a mainframe environment utilizing COBOL, IMS, and other mainframe-based tools; (2) most staff members were using terminals or a 286-based personal computer; (3) newer staff members from other university areas lacked an understanding of technology and analysis techniques; (4) understanding concepts of new distributed computing environments was limited, and (5) the opportunities for working in a team-based environment were not understood.

USAS management quickly assembled a list of short-term actions for creating a working environment favorable to change. These actions included the replacement of outdated hardware and software and the development of ongoing training programs to introduce new technologies and tools. The introduction of a "total" team concept and how it impacts work has been instrumental in helping the staff recognize different methods for achieving goals.

The list of short-term actions, however, is only an initial step. A total quality management program within the organization is essential if the staff is to receive the type of training necessary for success. USAS is emphasizing the need to expand general knowledge and, at the same time, have staff members develop specific expertise in areas to enhance the "project driven" style of operation.

Project Strategies

Although there is some reluctance to identify a specific methodology for re-engineering efforts at Virginia Tech, the USAS staff has implemented guidelines in three areas to enhance project activity. Specific techniques to improve user involvement, project reporting, and project guidelines are being utilized to reflect a new style of doing business.

User Involvement

A key component of change in the project strategy is user involvement. This does not mean that users were not involved in traditional methods, but their input has been refocused. The traditional development cycle at Virginia Tech was to address systems requests by analyzing needs, developing an in-depth proposal, writing code, testing, installation, documentation, and training. However, this procedure occurred in a vacuum, usually resulting in automation of existing processes and procedures. Users, normally consisting of internal departmental staff, were involved in the beginning and end but not during the entire process.

In a recent human resource team meeting, one member indicated that "people don't resist change...they resist being changed." The importance of user involvement has evolved to a new level at Virginia Tech. The diversity of users involved has changed and the team concept promotes user involvement from the early planning stages through implementation. Not only are specific departmental staffs included in all project phases, but an attempt is made to include all personnel who come in contact in some fashion with the processes being reworked.

Group sessions bring myriad users together and is one vehicle for obtaining a tremendous amount of information in a short time. Users are formed into groups, and group dynamic processes are used to uncover strengths, weaknesses, problems, and issues for the topic being discussed. An interesting by-product of group sessions is that people feel they really had a part in the rebuilding and redesigning process.

Traditional project teams normally consisted of technical personnel. Today, project teams also include internal operational staff, end users, and people who actually perform the work. These people work along side the technicians in developing working prototypes that stimulate additional thinking and, ultimately, a better finished product.

Project Reporting Style

Executive reports, scope of effort proposals, and white papers are often not fully read and understood because of their depth, detail, and computer jargon. Even though such documents are well-written and researched, individuals do not have time to muddle through long, exhaustive reports. Roberts writes "written reports have purpose only if read by the king" (Roberts, 1987). This statement may seem trivial, but lack of effective reporting is a significant problem in educating and informing individuals. USAS has implemented a new style of information delivery that has initially proven successful and has drawn compliments from key executives and administrators. Reports are now prepared that are simple, concise, and contain direct language (no computerese). Quite often before general distribution, a draft is presented to management in a round table format, and the reporting style usually becomes more of a discussion than a presentation.

Project Guidelines

No proven methodology exists yet for re-engineering. In fact, DeMarco and Lester suggest that imposing rigid methodologies inhibits risk taking and creativity, two important ingredients in re-engineering (DeMarco and Lister, 1987). In addition, guidelines currently in place proposed by the Commonwealth of Virginia are outdated and continue to use the 1970s mentality of traditional systems projects. However, some guidelines should be available on presenting a project in a consistent manner. An initial set of guidelines has been initiated by USAS to assure consistency for analysis and development of project plans. These guidelines are constantly reviewed and modified to increase their effectiveness and to adapt to the changing environment. A key aspect of the method is that senior management must "sign off" on each phase of the project guidelines before continuation to the next phase and before actual implementation begins. Additionally, if management determines that resources (dollars and/or personnel) are not available to implement the recommended changes, USAS has not invested the time and effort as was the case with traditional methods.

Project Definition The project definition phase of the guidelines involves taking a cursory scope of the project to be undertaken. Executive interviews are held to set the boundaries, identify the extent of commitments, and define the goals and objectives of the project. Depending on the size and complexity of the project, this phase may last from 3-10 days. A project definition statement will be given to higher-level management that identifies the description, justification, scope, initial resources (project analysis team), and the project analysis schedule (the next phase). The intent of this 2-3 page document is to minimize misunderstandings, eliminate wasted effort, and establish expectations.

Project Analysis The The project analysis phase, to be completed within 3 months, is intended to describe processes and work flow and to identify strengths, weaknesses, and areas for improvement. The initial focus is not to address technology issues but rather to determine how business is being conducted.

Interviews with various personnel provide the project team with a broad overview of problems, issues, and expectations. Group sessions have proven successful in identifying problems and issues with the status quo and are quick methods of gathering large amounts of information. Brainstorming sessions with project team members, as well as USAS staff and others outside the project, help generate new ideas and alternatives for change.

Re-engineering is expressed simply by Kriegel and Patler as "If it ain't broke...BREAK IT!" (Kriegel and Patler, 1991). Re-engineering requires that people think differently about how things are done, and this includes encouraging information technology professionals to view systems in a more open manner. The analysis and design must change from a focus on the primary user (registrar, comptroller, etc.) to one that goes beyond the boundaries, into areas where others are impacted. Penrod and Dolence refer to several key principles of re-engineering, but only a few of them have been emphasized in the early stages of re-engineering at Virginia Tech.

- Compress linear functions - capture information only once. Delays, entry errors, and the overhead of duplication can be eliminated.
- Analyze the way work is done - realign, redistribute, and consolidate the way work is done to enhance operations and reduce inefficiencies.
- Reposition decision and control functions - restructure work flow to locate decision points closer to where work is performed, thereby improving most operations.
- Implement appropriate technologies - evaluate processes based on the above principles to determine what (if any) technologies can contribute to improvements (Penrod and Dolence, 1991).

The analysis, still being done at a high level of detail, is broken into three separate but equally important areas and stresses that new projects are more than just systems solutions. *Process analysis* identifies and describes the major processes, inefficiencies in operations, and recommendations for improvement. *Organizational analysis* determines if and how the organization can be changed to eliminate unnecessary hierarchical lines of control, reflect more efficient work flow, and allow for better services to be provided. *System analysis* allows the project team to address the technology needs of the current system and determine where technology can increase the system's effectiveness. It is the coordination of all three types of analysis and their recommendations that provides the best opportunity for the project to be successful.

The major findings (good and bad), critical issues, feasible alternatives, and the project team's recommendation are presented in the new reporting style as an executive briefing. This format allows for immediate comments and discussion and for any misunderstandings to be corrected prior to other presentations and general distribution. The emphasis is on the re-engineering effort and not a presentation directed at technical solutions. The briefing focuses on processes, organization, and systems to show how they collectively must be changed to address service, quality, productivity, and cost.

Project Implementation Reaching Reaching the implementation phase is an indication that senior management (who initially requested the analysis) has agreed to all or part of the recommendation for change. Management will work with the analysis team to determine the implementation team structure. Obviously, more resources will be required. Analysis team members may be re-assigned and other resources brought on board. Remaining team members may take on different roles. Leadership, project management, technical, analytical, as well as other skills, are needed to produce the right mix of talent on the project.

Once established, the team educates itself in group dynamics, project vision, and objectives. More detailed analysis begins, and an implementation or action plan is developed within 2-3 months. The concepts of (1) modular development and delivery, (2) continuous improvement, and (3) the idea that no system can achieve perfection immediately are introduced. This scheme shows all progress quickly and allows for incremental improvements throughout the life of the system.

Initially, USAS has found the increased user involvement, the new reporting style, and the project guidelines to be successful. Several small projects have been completed and two larger projects, Enrollment Services and Human Resources, are just entering the implementation phase. These two larger projects will help determine if these new techniques will allow the USAS organization to deliver better products and services to the university.

USAS Prepares to March On!

This discussion has provided some insight into re-engineering efforts at Virginia Tech. The USAS organization was established to deal specifically with administrative systems and to assure that a new, aggressive, and innovation approach is used in this area.

The personnel involved with re-engineering efforts are "having more fun" than they have experienced in years. They are working in teams (not being restricted by traditions or how to solve problems), utilizing their expertise in different areas, recognizing management support, and realizing positive results. USAS staff and those involved from other university areas are seeing the impact they are having on their institution. These activities give them a sense of accomplishment and fosters the idea of pulling together in difficult times. They are actually becoming "the change agents" for Virginia Tech.

Word of the USAS mission and the idea of re-engineering is permeating around campus. Departments are calling weekly to have USAS work with them on improving operations. Unfortunately, resources are limited, but, with a priority procedure in place, projects (both large and small) are added to the lists on a regular basis. USAS management and staff are being asked to talk with groups, from student government to the Commission on Research, to discuss change. People throughout the university are interested in becoming part of the "change team" and are being encouraged, with appropriate team training, to be part of the new direction for administrative processes and systems.

Change is inevitable, and it is important change be viewed as positive. We can be the revolutionaries who get this moving and "sell" the concept that change is necessary for survival. Gordon Davies, Director of the State Council of Higher Education for Virginia, emphasized the need to rethink higher education and how it operates. "We should face up to the hard reality that higher education has to change if it is to continue its central role in American Society" (Davies, 1992). Do we have a choice?

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Organizing Support in a Distributed Computing Environment

by

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November 15, 1992

Brigham Young University

Provo, Utah

Brigham Young University, like most institutions, has experienced rapid growth in the use of distributed computing systems. However, the maintenance and support of distributed computing has not kept pace with its growth. BYU has researched several methods of support, ranging from departmental autonomy to a central hot-line for total campus support. Each method has met varying degrees of success as well as some major problems.

In light of their research, BYU implemented a method of computing support known as the "Computing Support Representative" (CSR) Program. This has provided the coordination and economy of scale of centralized support, while retaining the autonomy and responsiveness of decentralized support. The CSR Program is patterned after a national business franchise that provides the standards, support, and training of a centralized administration, while allowing each unit to operate much like an independent small business.

Introduction

In the 1970's, computing at Brigham Young University, like most institutions, consisted of a few large mainframes. In the 1980's, personal computers became more powerful and we started seeing more and more of the University's computing done on the desktop. Computing was becoming less centralized and more distributed. Early in the 1990's, another computing shift occurred. By networking these distributed computers we found that productivity would increase. Resources could be shared, so BYU installed a new fiber-optic based campus-wide ethernet network.

As computing changed, so did computing support. The support structure seemed to mirror the technology it was supporting. In the 1970's, support was centralized in one area, just as computing was. When employees had problems with the mainframe, there was only one place to call, mainframe support. In the 1980's as employees started having problems with their personal computers, mainframe support could no longer provide the answers they needed. We started to see computing support arranged at an organizational level, to help employees with needs specific to their organization. These internal support groups did not interact with support groups in other organizations unless absolutely necessary.

Realizing that computing support mirrored the technology it was supporting, it was decided that "networked support" was the model for the 1990's. By linking all these distributed support groups, solutions are found much faster, hence "networked support" is the basis of our computing support program.

No industry changes faster than computing. As the fundamental principles (paradigms) behind computing change, so must other aspects, such as computing support. Joel Barker defines a paradigm as follows.

> "A paradigm is a set of rules and regulations (written or unwritten) that does two things: (1) it establishes or defines boundaries; and (2) it tells you how to behave inside the boundaries in order to be successful."[1]

He goes further to compare a paradigm to a game such as tennis.

> "Is the game of tennis a paradigm? If you think about it for a minute, you'll discover that it is. Does the game of tennis have boundaries? Of course, that's the easy part. The tricky part has to do with success and problem solving. What is the problem in tennis? It's the ball coming over the net. And you must solve that problem according to the rules of tennis."

In the game of tennis, the rules haven't changed for many years, not so with computing, and the key is to learn the new rules to insure success. The paradigms governing computing are changing. Bigger is not necessarily better. Isolated personal computers are not the most efficient. Despite what their sales people will tell you, IBM personal computers are not necessarily better than the "clones". The paradigms governing computing support are also changing. What worked in the past will not necessarily work in the future. The rules of the game are changing. We offer the following solution to the changing paradigm of computing support and label it the Computing Support Representative program.

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[1] Joel A. Barker, Future Edge: discovering the new paradigms of success (New York : William Morrow, 1992) p.32.

Components of the Support Program

The five principles

There are five principles of computing support. With any one of these missing, your support program will not be effective. With all in place, the program will work efficiently and smoothly. These principles and the premises they are built upon follow.

1. Channel for resolving problems

Premise: The employees have more important things to do than fix problems with their computer.

The most obvious aspect of computing support is problem resolution as it is the most immediate. Not all your employees are involved in a computer related field, although a great number of them use computers daily. By keeping their computers running smoothly, and teaching them how to use their computers efficiently, your employees become more valuable. They not only increase productivity, but also enjoy their work more. Whenever an employee has a computing problem, they should be able to report it and feel confident that their computing support personnel will take responsibility for solving the problem quickly, without losing track of it. The employee also expects to be informed continually on the status of his or her problem. We have found that employees are not so much concerned how quickly the problem is resolved as being kept informed of its progress. Most employees understand that some problems are very difficult, and will require some time to solve. They need to be kept up to date and informed when their problem will be solved.

2. Channel for information to and from employees

Premise: The employees needs to know about their computing environment, and have concerns that need to be addressed by administration.

Resolving problems is very important. However, by establishing an information channel between your administration and employees, you can keep problems from happening. Your employees need information about their computing environment. They need to know about computing standards, changes to the network, when computing events are happening, what computing services are available to them, and more. A lack of communication leads to the employees distrust of their computing environment. Many fear what they don't understand. This distrust may appear as a reluctance to use the network, frustration in using "non-standard" or "non-supported" products, and even aggravation with those setting computing guidelines.

Your employees have ideas and concerns that the administration needs to address. The employee reports these issues to the CSR and the CSR polls other CSRs to find if there is an institution-wide need. The administration is then involved to resolve concerns and act on new ideas.

With proper communication in place, your employees won't be buying hardware or software that is incompatible with others in the organization. They can plan for scheduled network outages and changes, and they feel like their concerns are being addressed.

3. One phone number for employees to call

Premise: Employees will either experience "the run around" or won't know who to call for help.

Telephone support lists (stating who to call for which types of problems) do not work. We have tried them many times, and they do not promote quality support. Even if the employee knows who to call for what type of problem, they may not know what their problem is. They only know that they want to do something with their computer and it doesn't work right. The problem may be in the hardware, software, or even somewhere else on the network. Ralph Wilson, manager of training at Computer Hand Holding, Inc., sums it up this way.

> "In many organizations there are several help desks, one still devoted to mainframe access, one for PCs, and perhaps one for network issues and telecommunications. Throw in other phone numbers for hardware installation, maintenance, and telecommunication issues, and users are often confused when they have to decide who to call. Even support staff themselves may have trouble figuring out who's supposed to handle what."[2]

Every employee should have only one telephone number to call to report *all* computing problems, whither it deals with hardware, software, or operating systems on any platform used within the organization. The support person on the other end of the telephone should take responsibility for the problem, do some initial diagnoses, and call whoever is necessary to help get the problem resolved if he can't resolve it on his own. A single support telephone number eliminates the need to know who to call for help, is easier to remember that an entire telephone list, and eliminates run-around.

4. Problem coverage during normal working hours (8-5, M-F)

Premise: In emergency situations, employees need computing help immediately, and expect it during normal working hours.

Perhaps there is nothing more frustrating to an employee than to have a computing emergency, and have no one around to help them. Most of us have had the frustrating experience of needing a report printed in fifteen minutes, but for some reason the printer is not working. While other aspects of computing support are not as immediate, problem resolution needs to be available during normal working hours, even during lunch time.

5. Support person has allegiance to the organization

Premise: A support person within an organization knows more about the computing needs of their employees than any support personnel at an institution level.

For years we have been trying to implement some sort of campus level computing hot-line with varying degrees of success. No matter how many resources we poured into this campus level support, we could never hope to support anything more than the mainstream applications and common configurations. Those organizations that used applications or hardware specific to their discipline were always left on their own. The employee was required to support those items by themselves.

With a support person within the organization, we found that it was much easier to offer support. The support is tailor-made for the organization. The support person knows the software programs their employees are using, and knows what hardware platforms they are using them on. Even more important, the support person knows the professional background of the employees and can offer them solutions to computing projects that an institution support person could never offer. Employees view this support person as an insider and are less likely to become intimidated.

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[2] Ralph Wilson, Help! The art of computer technical support (Berkeley : Peachpit, 1991) p.40.

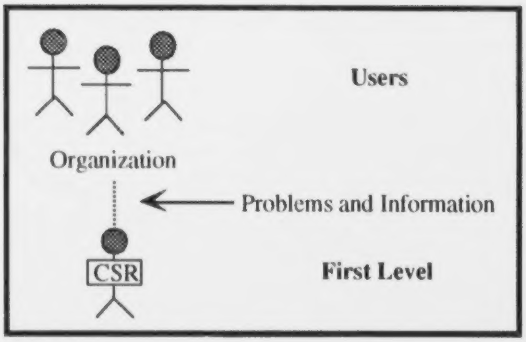

Figure 1

Tying it all together

Instead of the employees calling whomever they can, they contacts their organization support person. This support person already knows about the communications software and network connections that the employees are using. He also knows how the network is configured within the organization, and can most likely diagnose the problem area (mainframe, network, or workstation) in a matter of minutes. Once the problem is isolated, this support person can contact the appropriate service group and speak intelligently with them, resolving the problem much quicker, without a lot of anxiety on the part of the employee. This support person is what we call a Computing Support Representative or CSR.

The Computing Support Representative (1st Level)

The CSR is responsible for resolving problems and distributing information during normal working hours. From the employee's point of view, problems can be resolved by dialing a single support phone number. They know that *their* CSR is someone that knows them and their computing practices (see Figure 1). With the CSR program is place, there should never be a computing problem that can't be resolved to the employee's satisfaction.

The Computing Support Network

We have now identified a means for quality support by appointing a CSR to organize problem resolution and distributing information. This works as long as the CSR does not come across any problems that are out of his sphere of expertise. The key is to choose a CSR that is as familiar with the organization's needs as possible. We then train the CSR in the areas he is weak, and back the CSR with the experience of others. In the same way as a number of personal computers on a network become more powerful than single computers by themselves, a network of CSRs can become more powerful than a group of single CSRs. This linking of collective knowledge of all the CSRs becomes the Computing Support Network. Let me emphasize that this is not a computer network made up of wires, but a people network where information and ideas can be shared.

All of our CSRs have talents in their own specific areas, both from background and because of the special needs of their organization. One CSR may be very adept at solving Novell Netware problems, yet be weak in Unix. Another may understand Unix, yet not understand the intricacies of setting up MS Windows. When one CSR has a problem or question that he cannot resolve, he can feed it into the Computing Support Network and other CSRs can help him

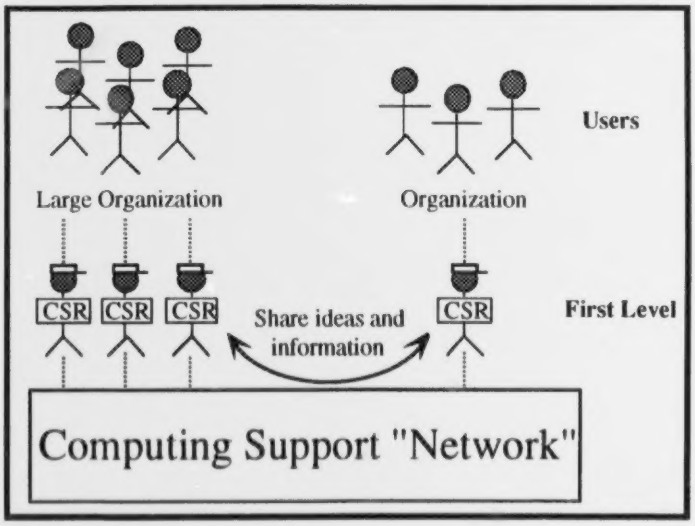

Figure 2

(see Figure 2). Exactly how this happens is covered later in the section on CSR communication.

The Computing Support Team (2nd Level)

The Computing Support Network works very well for resolving problems a CSR may not be familiar with, however CSR to CSR communication is not enough. There are times when a CSR will be faced with a nasty sort of problem that may spread across many different areas of expertise. For example, the problem may involve a conflict between a software network driver, the network card, and a file server. To resolve these really tough problems, they need to be escalated above the CSR to a second level of support.

This second level of support consists of institution level experts that work together to resolve problems. These are some of the most experienced people in diagnosing hardware problems, application problems, database design problems, network problems, mainframe problems, operating system problems, etcetera (see Figure 3). If a CSR escalates a problem to the second level, then there is a good chance that it will require multiple experts working together to find a solution. The CSR is still responsible for resolving the problem, however the second level will work with the CSR to diagnose the problem and offer possible solutions. With this second level in place, the CSR is never put in the awkward position of being responsible for resolving a problem, but not given a way to do so.

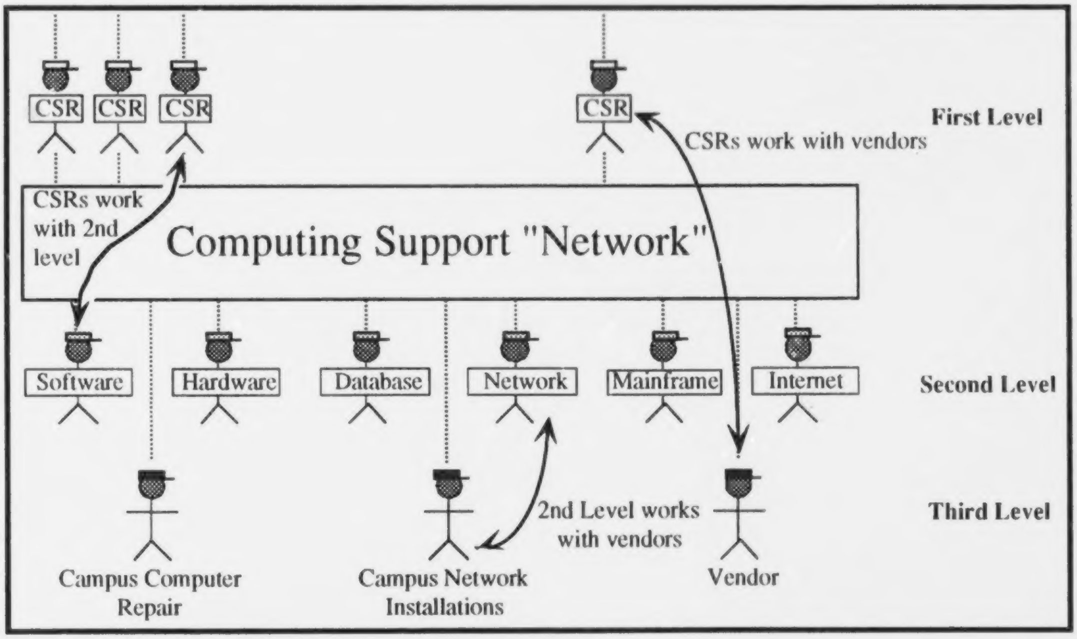
CSR
CSR
CSR
CSR
First Level
CSRs work with vendors
CSRs work with 2nd level
Computing Support "Network"
Software
Hardware
Database
Network
Mainframe
Internet
Second Level
Third Level
2nd Level works with vendors
Campus Computer Repair
Campus Network Installations
Vendor

Figure 3

The Vendor Connection (3rd Level)

Computing vendors play an important role in the Computing Support Network. It is every vendors dream to be able to contact all of the employees in an institution that are interested in their products without bothering those who aren't. By using the Computing Support Network, a vendor can keep the CSRs up to date on bug fixes and new releases of their products. In turn the CSRs can pass this information on to those within their organization that they know are interested in the vendor's products. For example, Microsoft may have just released version 2.0b of it's Word for Windows product. The upgrade is free and fixes a few bugs in the previous release. The Microsoft representative can give this information to the CSRs who in turn can pass it along to all their MS Windows users while not bothering their Macintosh users. Using the Computing Support Network, vendors can also announce presentations and seminars that employees may be interested in (see Figure 3).

The Computing Support Network works both ways. Not only can vendors keep the CSRs informed, but the CSRs can inform the vendor of bugs, complaints, and possible enhancements the employees in their organization need. The CSR sometimes speak for hundreds of employees, and when the vendors realize this, they will be motivated to act on the CSRs recommendations. Sometimes the vendor will need to be involved in the problem resolution process, and by linking them into the Computing Support Network, the CSRs know who to contact and generally receive better attention than an unknown user. This leads to a very good relationship between an institution and the vendors that supply them products. At the present time, we have good communication with Cicso, Microsoft, Apple Computer, Novell, and others. We also treat our campus services (computer repair and network installation) as vendors.

The Computing Support Coordinator

We have now described a support structure that is complete except for one part that makes everything work. This part is the Computing Support Coordinator who is a person who ensures that effective communication and problem management occurs between all three support levels. The Computing Support Coordinator is also an evangelist for the support program who can transfer enthusiasm, along with concepts and principles of the support program, to administrators and CSRs. The duties of the Computing Support Coordinator are as follows:

1. Act as problem manager. Track problems that get escalated from the first level to the second level. This ensures that no problems get lost and that solutions are properly cataloged for future reference by CSRs.

2. Coordinate Communication among the CSRs and technical support staff. The Computing Support Coordinator acts as a "directory" in the network of CSRs. When the CSRs do not know who to call for a given problem they can contact the Computing Support Coordinator who will direct them to a person who can help them.

3. Train CSRs. The Computing Support Coordinator accomplishes training through specialized training classes which focus on specific topics that the CSRs need to know. These classes can be taught by second level support personnel, or by other CSRs. Classes not only help train the CSRs but also bring them together so they can learn more about the skills and interests of one another. This helps foster a networked support environment.

4. Publish a periodic newsletter. Newsletters help keep the CSRs informed of new methods of support and the appropriate use of computing technology for their employees. The newsletter also provides a forum so that CSRs with particular specialties can contribute to the Computing Support Network by publishing articles about their own expertise.

5. Audit problem resolution. The Computing Support Coordinator contacts CSRs, as well as employees, to get feedback on how computing support is being perceived within the institution. This follow-up acts as a quality control indicator to keep the computing support structure service-oriented.

6. Focus support personnel on solutions to problems. Individuals with in-depth knowledge of particular computing technology sometimes become so focused on the activity of investigating solutions that they forget to solve the problem. The Computing Support Coordinator helps to channel their energy in productive ways.

How to set up the Support Program

Initial Setup

This next section describes the preliminary steps to organizing this computing support structure at your institution. It should give you a good idea of the resources and time involved.

Who is responsible for resolving computing problems?

One of the first questions you must ask yourself is "Who is responsible for resolving computing problems?" If you are wise, you won't ask this question too loudly until you have decided the answer for yourself.

At Brigham Young University, we found that it would be best if each college were responsible for providing support for their employees, and structured our support program around that premise. While this is probably the best approach for most large institutions, it may not be right for all. For example, our Hawaii campus is about 1/15th the size of our main campus, serving approximately 2000 students with 200 employees in 18 major divisions. We found it impractical to try and appoint support personnel in every division, and decided to assign Computer Support Services (campus level support) the responsibility of resolving computing problems. A CSR was then appointed in each division to act as an information channel and consultant for computing issues.

Hire a Computing Support Coordinator

Look around your institution and see who is responsible for insuring the employees are receiving quality support. If you don't see anyone, or see multiple people in various divisions, then chances are you won't see quality support. It is essential that a Computing Support Coordinator be hired to get your support program off the ground.

Assess Size of job and Resources available

You have a big task ahead of you, and you need to formulate a game plan. You will want to make sure you know what resources you have currently available and where more resources are likely to be needed. Start by sitting down with an organizational chart of your institution. Highlight the major organizations, organizations that work closely together and those that don't due to geographic or political separation. Record the number of employees in each organization, and any support resources that may exist on campus, such as help desks, computer labs, known computing specialists, hardware support contracts, campus level services, etc. It may also be helpful to take a walking tour of various organizations to find out how they use their computers, and how they presently resolve problems.

How many support people should be employed? PC Week surveyed over 500 corporations making up their Corporate Advisory Panel and found that each support employee was supporting 77.5 computers in 1988 (up from 73.4 the year before)[3]. With the CSR program properly in place, we have seen a single full time support person supporting over 100 employees, and the quality of support is greater than when our support people were closer to the 77.5 ratio and didn't have networked support. Here is a rare case when you can have the best of both worlds; better support for less expense.

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[3] Ralph Wilson, Help! The art of computer technical support (Berkeley : Peachpit, 1991) p.49.

Obtain Support from Administration

Organizing a new support program that encompasses your entire institution will involve change, which is often resisted and sometimes painful. At some point you will be asked by what authority you can dictate this change. You will need support from the highest levels of administration if your new support program is to succeed. If your administration is in touch with the employees, they will know that there is a need for the five principles of the computing support program, and will welcome a way to provide efficient support for the institution.

Meet with organizational leaders

Once you have support from the administration, it is time to work with organizational leaders to appoint someone as the Computing Support Representative within the organization. You will need to arrange a meeting with them, or at the least send a memo to them explaining the role of a CSR and the need of having this person affiliated with their organization. Any organization that uses computers has some way of supporting them, even if it is undocumented and confusing. It may be some internal support organization, file server administrator, or enthusiastic secretary. The organizational leader will help you by specifying the person she feels is most qualified to coordinate support. This will give you a place to start.

Opening CSR Meeting

Now that you have a number of people appointed to be CSRs, you will want to set up a meeting with them to explain the CSR program in detail, and notify them when future CSR meetings will be held.

Establish CSR Communication

The need for effective communication can not be stressed enough. There are three types of communication necessary for CSRs; time critical, general information, and reference.

Email List (Listserv) and Newsgroup (Usenet)

For time critical information, nothing beats electronic mail (e-mail). No matter how prevalent e-mail is in your institution, the CSR must have an e-mail account to link him to the Computing Support Coordinator. Hopefully, every employee will also be using e-mail, making it easier for the CSR to distribute information to the employees within the organization quickly and easily.

At BYU, we use two different ways to distribute this time critical information. First, we use a Listserv[4] e-mail list. All of the CSRs (and even some interested employees) subscribe to this e-mail list. Information such as virus alerts, scheduled network outages, vendor announcements, and surplus equipment lists are sent to the CSRs, who in turn pass along this information to interested employees. CSRs use this e-mail list to post questions to other CSRs. This e-mail list is also mirrored on a Usenet Newsgroup for those CSRs that prefer to read and post information in that manner.

Monthly Meetings

Monthly CSR meetings are held to disseminate important information that is not time critical. These meetings are held once a month at the same time and place, and are never longer than one hour. We have found that most of our CSRs are too busy to devote a large amount of time to long or frequent meetings, and that all the information they need can be distributed in an hour or less.

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[4] Eric Thomas, Revised LISTSERV: BITNET-Oriented Presentation email "Info Pr" to LISTSERV@RICEVM1.RICE.EDU. February 1987

In monthly meetings we cover such things as campus computing standards that have changed, proposed new standards, problems that keep cropping up in different organizations along with their solution, and anything that would be too complicated to convey in writing. These meetings also foster CSR to CSR contact that enhances networked support.

Training Meetings

The key to quick problem resolution is to have well trained CSRs. Most of the CSRs will be clever in certain aspects of computing, but may be weak in others. It is your goal to get all your CSRs trained in the basics of computing support. Our training classes are taught by both second level support personnel and CSRs in areas such as the Internet, operating system software, diagnosing hardware problems, database design issues, Novell Netware, and others.

Newsletter

A monthly newsletter is published with any information that the CSRs may need to refer to in the future. There are articles on common problems and their step-by-step solutions, articles that explain topics such as networking, and articles on campus standards. These articles are written by the Computing Support Coordinator, second level support personnel, and even CSRs.

CSRs are encouraged to distribute a newsletter within their own organization with information that is specific to their computing. To facilitate this, we make all of our campus newsletter articles available to our CSRs in electronic format so they can include any of the campus articles in their own newsletters.

CSR Phone List

Your goal is to define a CSR for every employee within your institution. The easiest place to start is to assign CSRs along political or geographic boundaries within your institution. You also need an easy way for employees to determine who their CSR is. We started by making a list of all the organizations within our institution with information about the director and the CSR (see Figure 4).

Department	Dean/Director	Address	Ext.	C.S.R.	Address	Ext.	E-Mail Address
ACADEMIC AREAS							
Admissions and Records	Clark T. Andersen	A-485 ASB	8-4321	Steve Lee	B-432 ASB	8-4249	svl@arlan.byu.edu
				Mark Whitehead (Financial Aid)	A-21 ASB	8-8753	mjw@arlan.byu.edu
Biology and Agriculture	Richard C. Smith	142 HCEB	8-6338	Armand Crowther (Macintosh)	988 WIDB	8-0935	crowthera@yvax.byu.edu
				John Webb (IBM PC)	24 WIDB	8-4811	lwebj@yvax.byu.edu
Cooperative Education	Erlend D. Huber	722 FOB	8-9355	Julie Trujillo	1022 FOB	8-6352	insjlt@foblan.byu.edu
Continuing Education	Clayton S. Peterson	419 WIDB	8-0306	Dan Hatch	523 HCEB	8-8354	conted_csr@byu.edu
Economics	Dan W. Smoot	413 FOB	8-6453	Shawn Burton	499FOB	8-9565	ecostb@vm.byu.edu
Education	L. Douglas Pope	766 MCKB	8-9112	Steve Jordan	20 MCKB	8-8744	edu_csr@byu.edu
Engineering and Technology	Rulon Thorstenson	513 CB	8-8021	Stacey Burgon (Dean's Office)	1448 CB	8-5562	sburg@byu.edu
				Mike Flanagan (Chemical Eng.)	2452 CB	8-0923	flanam@caedm.byu.edu
				Norm Wallace (Civil Eng.)	49 CB	8-4636	walacn@caedm.byu.edu
				Kelly Beliveau (Electrical Eng.)	1582 CB	8-5412	kelly@ee.byu.edu
				Don Hale (Mechanical Eng.)	15L CB	8-2222	haled@caedm.byu.edu
				Bruce Son (MFET, EET)	4592 CTB	8-5488	sonb@caedm.byu.edu

Figure 4

Send information to end users

With all of the above in place, you are now ready to advertise the CSR program to your entire institution. Don't let it concern you if it takes you a while to get to this point. There are a lot of changes involved in organizing such a program, and changes take time, but it is worth the effort and the wait. It took us almost two years to implement this program at BYU. Hopefully this document will help you to avoid the pitfalls we fell into, and you will be able to set up the program much more quickly.

Advertise the support program

If you have an institution-wide newsletter, this may be a good place to start. The main points to cover are that all employees have one phone number to call for any computing problem, and that they will be receiving information within their organization on what that number is and how to use it.

Personalized information

You will need to send out information to all the employees individually. This information should be personalized to explain how *they* use the CSR program. Although all of our organizations follow the five CSR principles, none of them are set up exactly the same. We printed up a brochure that details the duties and responsibilities of a CSR, and left a space where personalized information could be printed, such as the phone number that employees should use to report computing problems.

This brochure was then sent to every employee with a memo from the organization's CSR describing who he was, and how he would help them get answers to computing problems. Also included is a sticker identifying the CSR and their support phone number which can be adhered to the front of the employees computer, the employees phone, or a Rolodex card.

Explanation letter to organization leader

In addition to the personalized information being sent to every employee, the organizational leader receives a special memo describing how the CSR program is operating within the organization, and how the Computing Support Network will back up the CSR when he has really tough problems. This memo can be sent from the Computing Support Coordinator.

Build CSR Resources

Once you have the CSR program in place, you need to concentrate on providing resources for your CSRs. You're goal is to make it as easy as possible for them to solve problems. You will want to implement a problem tracking system so your CSRs and second level support personnel can work together on a problem without losing track of it. Give each CSR a three ring binder to store handouts and newsletters for future reference. Create quick reference guides on everything from electronic mail to network installations for both CSRs and employees. Set up an on-line information source such as Gopher[5] to archive support information that is easily retrievable, and create a CSR library that contains manuals, reference books, and software that CSRs find useful.

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[5] Gopher clients, servers, and documentation are available via anonymous FTP to boombox.micro.umn.edu.

Developing Effective User Training Programs at The University of Michigan

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Abstract

Designing effective end-user training at Michigan is a result of user involvement, a responsive and talented training staff, and diversified formats for different subjects and audiences. This session is designed to acquaint training providers and designers with some of the ways in which Michigan actively solicits user feedback on workshops and works together with managers and faculty to design training that is reflective of their needs. This presentation will give an overview of the University of Michigan's computer training program which serves over 10,000 faculty, staff, and students each year. The goals and scope of Michigan's program will be described and the ways in which user feedback is solicited and used will be explored. Additional topics covered include curriculum planning, the role of non-classroom training, measuring program effectiveness, preparation of new instructors, and partnerships with administrative offices, managers, and faculty.

Introduction

This paper will introduce the end-user training program at The University of Michigan by focusing on organization, training formats, staff preparation, and how users help shape our program. It is hoped that by telling a little of the Michigan "story," others will have the opportunity to benefit from our experience as well as their own.

Overview of the Michigan Program

End-user training is designed to enable faculty, staff, and students to effectively use the technology available on campus. This might include information about the campus computing environment as well as training in specific technologies. Training is provided in a variety of formats including:

- Regularly-scheduled workshops (approx. 650 hours per term; approx. 100 course titles).
- Ad-hoc workshops by special request of faculty or staff groups.
- Computer-based tutorial/simulations (commercial products as well as some developed by our own staff).
- Special programs for students (Residence Hall instruction and introductory classes in the campus computing sites).
- Short presentations as part of special campus-wide events on a particular topic.

Information technology services are the responsibility of the Information Technology Division (ITD). The following units comprise ITD:

- University Information Systems (administrative system development)
- Research Systems (mainframe and supercomputing services for researchers and academic users)
- Instructional Technology Systems (campus computing sites, computer classrooms, and instructional uses of technology including courseware development)
- Consulting and Support Services (training, consulting, documentation, and planning services; publicity and needs assessment activities)
- Resource Administration (internal personnel and budgets)
- Network Systems (voice, data, and video networking services)

Instructors for workshops are drawn primarily from the Consulting and Support Services staff, but also from other areas of ITD. In particular, we depend upon staff from our Network Systems group to teach networking classes and upon staff from the Instructional Technology Systems group to teach courses in authoring systems.

The ITD Education Manager is a part of the Consulting and Support Services (CSS) management team and functionally manages the instructional staff although they report administratively to other managers. The main advantage of this "functional management" approach is that we're better able to draw upon the expertise of the entire organization and assign the best person to a particular teaching assignment. We're also able to provide staff with a more varied set of responsibilities. The functional Education group of approximately 30 instructors is divided into topic areas with a coordinator for each area. The topic areas are:

- Systems Use (Macintosh, DOS, UNIX, and MTS (Michigan Terminal System, our academic mainframe operating system)
- Administrative Data
- Electronic Mail and Conferencing
- Database Management
- Desktop Publishing
- Graphics
- Spreadsheeting
- Word Processing
- Statistical Computing
- Networking and Data Communications
- Authoring Systems and Instructional Technology

Topic Coordinators meet once per month as a group and are charged with the continuous improvement of the curriculum in their areas. They meet with the other instructors in their area as needed throughout the year. The entire Education group meets monthly to discuss common issues related to teaching, workshop design, and to identify and provide guidance on any problems that arise.

Other staffing needs are met by staff from elsewhere in the Consulting and Support Services group -- all reporting functionally to the Education Manager. These include documentation staff for design of a workshop handout style and editing of publications, clerical support for training materials duplication, network administrators for maintenance of the teaching labs and networks. An additional full-time registration clerk, who reports to the Education Manager, handles program registrations, billing, and tallying of program evaluation data.

Curriculum Planning

Curriculum planning is an ongoing process which culminates each semester in an assessment of what classes should be taught, how frequently, and when in the semester each should be offered. In order to meet deadlines for publication of the course schedule, the curriculum for each semester is finalized approximately two to three months in advance of the start of the semester. In instructor meetings and discussions, care is given to make sure that curriculum changes are thought through with implications on the entire program. Instructors of courses in a sequence pay particular attention to how their workshops complement one another. When changes are introduced, we're careful not to duplicate efforts or assume that someone else is covering an important subject.

Modifications to classes might be made on the basis of participant feedback or because of changes in the technology or the campus computing environment. Instructors review summaries of workshop evaluations and other sources of data about participant needs. They also stay abreast of changes in commercial software products, new programs and services being developed on campus for which training will be necessary, and work with other consultants to identify common problems of users that could be addressed in training.

Other information about user training needs come from campus-wide forums (both electronic conferences and actual focus group sessions with users) and by working in partnership with faculty, staff, and students in the community. For more about partnership efforts, see page 8.

Training Formats

While hands-on workshops have been the mainstay of our training program, self-paced computer-based tutorial/simulations are becoming an increasingly attractive alternative or supplement to workshop training. There are a variety of reasons for this, including:

- Individual conflicts with workshop schedules may make it inconvenient to attend a workshop.
- With personal tutorials, training is always available "on demand." There is no need to wait for a workshop.
- Users of a computer-based tutorial/simulation can work at their own pace.
- Unlike printed tutorials, computer tutorials provide corrective feedback when a mistake is made.

We have developed two computer simulations to introduce new users to services on our academic mainframe . The first tutorial to train users of an administrative system is planned for the spring/summer term in 1993.

This semester, we introduced commercially available tutorials for which we acquired campus wide site licenses. These tutorials cover DOS, Windows, dBASE, Lotus, and WordPerfect. All tutorials are available for use in campus computing sites andavailable for staff and faculty use in their offices. We are additionally requesting that our campus computing sites routinely install the vendor tutorials that accompany the software at the sites.

We are experimenting with using computer-based tutorials in a workshop setting. In training new users of our academic mainframe system, the computer-based tutorial received very high praise from users in a classroom setting. They liked working at their own pace, always getting feedback or help when needed, and having all their individual questions answered without worrying about disrupting the class or overwhelming new people in the workshop.

While we were initially concerned that users might not like the computer-based tutorials, this concern has turned out to be seldom encountered. One instructor who experimented with a commercial Windows tutorial for part of a workshop found it hard to get the participants to leave the tutorial for some more traditional instructor-led instruction. The color and animations were just too engaging!

In the past, we also experimented with lecture/demonstration classes to train a large number of new mainframe users within a short period of time. The effectiveness of these classes, however, was severely reduced if the participants didn't follow up with a hands-on experience soon after the lecture. Our experience was that participants often did not do the hands-on exercises after the lecture and thus reduced the extent of their learning significantly.

As user experience levels grow, we're also finding that short, very-focused presentations can be very effective and more likely to draw an audience than longer, more comprehensive training sessions. We're finding that we can reach a sophisticated audience by offering training as part of a larger campus-wide special event on a particular topic. This fall, we held a day-long event "Working Smarter with Databases and Spreadsheets." As part of this event, a series of ongoing very speciifc half-hour presentations drew a capacity crowd (50 participants at each half-hour session). It appears that this kind of short lecture/demonstration is just what is needed for an experienced audience and we'll be exploring scheduling more of these in the winter term.

Staffing and Preparing New Instructors

With 10,000+ registrations for workshops, this is clearly our primary vehicle for training. The strength of this program is is largely the result of a talented and caring staff who take great pride in their teaching. In recruiting new staff, we look for people who not only know their subject, but also have excellent interpersonal skills and the ability to organize their presentations and written materials logically.

To prepare new teachers, we developed several strategies:

- A buddy system for preparing new instructors. New instructors sit in on classes of an experienced instructor and gradually take on responsbility for solo teaching.
- A self-evaluation form for instructors to use when preparing for classes. (See copy of form below.)
- Sharing of tips, ideas, and problems at monthly teacher meetings.
- An instructor handbook for policies/procedures and a description of our philosophy of "good teaching." Copies of this handbook are available upon request.
- Gradually, over time, created a very high standard of excellence for new instructors (as well as old) to live up to.

That the above strategies work is borne out by the consistently high comments our instructional staff earn from the participants in their classes. Caring, patient, and knowledgeable are the most typical set of adjectives that workshop participants use to describe their instructors.

Instructor Self-Evaluation Form (reprinted from the Instructor's Handbook):

Monitoring Workshop Quality: Instructor Self-Evaluation Form

The following self-evaluation form was developed by ITD-CSS workshop instructors and reflects the qualities we think are important for successful workshops. Please use this form as a yardstick to measure your own performance and we invite your feedback on the form.

Classroom Environment

+ Before the students arrive, is the classroom neat and the temperature comfortable?

+Have you checked to make sure that all equipment is working?

Clarity of Presentation

Voice projection:

+ Can people hear you at all times throughout the classroom?

Clear directions and instructions:

+ Are your directions to students clear?

+ Do they know what they are supposed to be doing as you progress through the workshop?

Clear explanation of concepts:

+ Do you explain new material clearly?

+ Do you define new terms when you use them?

+ Do you choose analogies that can make concepts easier to understand?

Rapport with Students

+ Are your interactions with students, warm, hospitable, personable, friendly as opposed to rude and abrupt?

+Are you patient with your students?

+ Are you supportive and helpful as opposed to condescending and arrogant?

+Do you convey enthusiasm about the subject matter?

Workshop Organization

Introduction:

+ Does your workshop introduction set the appropriate foundation for the workshop? (Goals, objectives, prerequisites, format, seating arrangements)

Content Presentation:

+ Does your workshop progress logically?

+ Does the structure allow for an appropriate balance between lecture and participant involvement?

- + Are the exercises well thought out and able to be completed in the time allowed?
- + Is the timing of each section appropriate to its importance and complexity?
- + Does the pace reflect the experience of the target audience? Are you able to accommodate faster and slower learners?

Conclusion:

- + How effective is your closing statement(s) in tying together all elements of the workshop?
- \+Are additional resources mentioned?

Handling Problem Situations

- \+How effective are you at handling questions beyond the scope of the class?
- + How are you handling questions that you do not have the expertise to answer?
- + How effectively are you handling students who can't keep up with the pace of the class?
- + How well are you handling latecomers?
- + How well are you handling participants without necessary prerequisites?

Outstanding Qualities of Presentation

+ What are you doing that's working exceptionally well for you?
analogies?
making people comfortable?
exercises that work well for slower and faster learners?
a strategy for involving participants in lecture/demonstrations?
making people laugh and enjoy themselves?

Please share these at group meetings or in the staff conference.

In the next two sections, we will discuss the ways in which working with our users and listening to their needs and comments help us design and improve classes. There are essentially two ways in which our users help us increase our effectiveness. One is by giving us feedback immediately after classes or in a follow-up telephone survey and the other is by working with us in partnership.

Measuring Program Effectiveness

Our workshop evaluation form, which is distributed to each participant after each class, asks about the presentation of material, the skills of the presenter, the organization and content of the class, classroom facilities, and anything else participants want to share with us. We also ask about other training that might be desired in the future. Instructors set the stage for a very high return rate by assuring all participants that the evaluations will be read carefully and that they will be the basis for improving the workshop for future participants.

There has been much discussion among trainers about the quality of information that such evaluations yield. Some trainers in the industry have dismissed them entirely as being nothing more than "smile sheets" for instructors which reflect more about the geniality of an instructor than about his or her ability to teach or the appropriateness of the workshop content. While there is some truth to this, no doubt, the evaluations do reveal content and organizational weaknesses of a class and offer a unique opportunity to identify and fix problems in classes before they are offered again.

Concerned, however, that relying exclusively on workshop evaluations did not accuaratety tell us how effectively our classes give people the skills they need, we decided to to do a follow-up survey with participants. In the past few months, we designed and piloted a post-workshop telephone survey that could tell us if the content of our workshops was meeting actual participant needs and if they could, in fact, use the information and skills they learned in class in their own work. Copies of both the workshop evaluation form and the follow-up telephone survey are available upon request.

While we are just beginning to survey participants, the results of the pilot survey give a glimpse of what we might learn from the surveys. The pilot was actually designed to test the form and learn more about the skills needed to make the survey calls. Nevertheless, comparing the information we received from each type of evaluation for two word processing classes in the pilot, we see the following new information emerging:

- The telephone survey reaches fewer participants than in-class evaluations.
- The majority of participants are actually using the product/information they learned about in training. (There is no way of knowing this in evaluations after class). Those who were not indicated that they would be using their new skills soon when they started a new project. One person called said that they would be using it at home if not on the job.
- The workshop covered what people actually needed and they did indeed learn the material. (There is no way of knowing this in evaluations after class. We can only know about anticipated need or perceived effectiveness of training.)
- Some of the people surveyed told us about additional training they wanted. Although we might not always add the suggested content to the class they took, this gave us an opportunity to describe additional training available or alerted us to needs not being already met by the curriculum.
- Participants told us how they use workshop handouts after class. Although we suspected they were useful as reference or for training others in an office, the survey confirmed that this is happening with great regularity.

These results are reported here only as a preview of the kind of information that we will learn from the survey. Because only a few classes were surveyed in the pilot, the actual information is, at best, tentative.

It is interesting to note that in both the telephone survey and the workshop evaluations, suggestions for improvement or on what to keep doing are very similar. There is not a lot of difference in responses, although the telephone survey comments do appear to be a little more general and reflective. For example, one person volunteered that they have difficulty attending a class when it is only offered once in a term. This kind of information does not normally come out in a written workshop evaluation form. Similarly, another respondent in the telephone survey revealed that they have difficulty getting enough hands-on experience when they work with an *experienced* partner in a workshop.

All respondents we reached were eager to take part in the survey and pleased to hear from us. It was sometimes necessary to call back several times to reach someone. Other times we may have had to make an appointment for a convenient time to call back. Each survey call took about 5 minutes to complete. Callers felt that it was generally not necessary to be very familiar with the topic of the class. They did feel though that knowledge of our ITD services was important since the calls were also an opportunity to help people find out about other services they needed.

Because it is a time-consuming task, not all instructors are enthusiastic about making these calls. All are looking forward to the information they will yield, however. This semester we are having calls made by instructors on a voluntary basis and by our full-time registration clerk. Instructors making calls are working in partnership with a colleague so that each is calling about a workshop of the other. Results of the surveys will be tallied and shared with the individual instructor of each class surveyed. Instructors will, in turn, share the results with their colleagues in curriculum meetings. Results of general interest to all instructors will be shared among the larger group of instructors.

Partnerships

Working in partnership with users to meet their needs is another way in which we offer our services to the community. Partnerships typically take one of three different forms:

- Working with an administrative office to train on a new system they have initiated.
- Working with a faculty member to help his or her students get the skills they need.
- Working with a departmental administrator or local area networking administrator to train his or her staff.

In all cases, working in partnership gives us an opportunity to learn more about the larger environment in which we work and the work and needs of those who use our services -- the "real world" context in which people use the computer skills we teach. These opportunities often have an effect on the regular classes we teach. As we learn more about the environment of our users, we're better able to make our offerings more reflective of their needs.

An example of an administrative office partnership is the training we provided with the University's Development Office to train users of their new mainframe computer system. This involved co-designing and teaching workshops that not only covered the basics of the computer system, but also covered how the system could be put to good use by development officers and new ways of working in some cases. The computer aspects of the training were the domain of our ITD staff. The more job-related components were the domain of the Development Office. The quality of this training was enhanced by each of us attending to the parts we knew best.

An example of partnering with a faculty member is the many workshops we do for classes at the request of faculty. Sometimes we make our materials available to TA's and faculty and consult with them on their use. Other times, however, it is best for us to do the training. The workshop might be identical to what we regularly offer, or we might work with a faculty member to tailor the content for the specific needs of the students and a specific class activity.

The third type of partnership involves designing training for a departmental group which might be getting new computers, new programs, or a new network installation. Or, an administrator might desire to enhance the skills of his or her faculty or staff. In meeting with the key administrators in the department we learn more about the needs of his or her group and can modify our standard training as needed. It is important to know that the administrator who is speaking on behalf of other staff or faculty is, in fact, aware of the actual needs and constraints on time for training. We have learned the proverbial hard way that this can not be taken for granted. Sometimes, it is necessary to ask an administrator to better identify needs and to assist them in the process. It can be a costly waste of resources if the training does not match what is needed or if the administrator has not paid attention to time and schedule constraints.
Some administrators have foundthat it is better to work out individual training plans with staff and makes use of our regular workshops than to set up a program for their department as a while. Special training for a group or department worked best when a new system or network is being installed and everyone needs to learn the same thing at the same time.

Challenges

We face challenges in the coming year that are partly related to changing technologies, partly to the economy, and partly to the widening gap between experienced and novice computer users.

At The University of Michigan, one of the issues with which we must contend is reduced resources coupled with the need to move into new areas of activity. A growth in new activities is unfortunately not always accompanied by a growth in resources. This means that we must find ways to train our existing staff to take on new responsibilities and we must find a way to let go of ongoing activities. In education, this has meant cutting back some services to allow more time for staff development. We are substituting non staff-intensive activities such as commercial computer tutorials to free up staff for new activities. It will be important for us to monitor the success of these substitutions and to actively solicit user input and actively listen to what our users have to say about them. As services are considered for reduction, it is important for us to engage in an active dialog with users about what the potential service cuts will mean to each of us and what other options there might be. We must be very aware of the real needs of our community since we literally can not afford to offer services that are not needed; nor can we afford to overlook those that are.

Another challenge we face is the widening gap of skills in classes. As more and more of our users become sophisticated computer users, the audience we serve is increasingly more differentiated. "One size fits all classes" will fit increasingly fewer students. It's important to recognize this trend and provide learning opportunities that can be customized for different participants in a single class. It will not always be practical to offer several classes for different audiences. The person learning how to use Microsoft Excel as their first spreadsheet program, for example, has different needs and will learn differently than a person switching from another spreadsheet program.

Finally, the last challenge addressed here is the need to explore the best ways to reach the most sophisticated users. Workshops might not be best for this audience, but rather short talks, demos, articles, and tips. We've had good success experimenting with short, to the point presentations and articles in newsletters for this group. More is yet to be done and more information from this growing community will be critical. We need to teach people not only how to *work* the new technology, but how to *work smarter* with it.

It's All in the Name - Implementing Data Element Naming Standards

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ABSTRACT

Data element naming standards promote and facilitate data sharing across systems and among data users by proving a means for making data readily identifiable. At the University of Michigan one of the charges of the newly established Data Administration area is to develop and implement standards for naming and defining data. A working group was established to make recommendations for standards for institutional data. This group conducted research on standards used at other institutions in order to propose naming standards which could be applied to both internal and external data. This paper focuses on the goals and activities of the Data Element Naming Standards Working Group (DENS), their successes and obstacles, end users' and programmers' reactions to the proposed standards, and how these standards are being implemented at the University.

INTRODUCTION

Data is an important asset to the University of Michigan. Since data is an institutional resource, it is appropriate that formal standards and guidelines be developed and used to manage and control data. Just as accounting standards help to manage the University's finances, data standards can help to manage the University's data resources. In the past, data was often viewed as belonging to a single department or business application. This meant that data was not always defined or named in such a way that it could be readily understood or shared by other departments or applications. Today, customers and information systems staff alike face a critical need to be able to merge and analyze data from many different systems in order to make informed decisions. One way to facilitate this process is through the use of data standards.

What are Data Standards?

Data standards comprise the rules for defining, documenting, and naming data. At the U-M, such standards are evolving and currently consist of various kinds of recommendations and approved lists, including the following:

- Guidelines for defining data elements
- Major classifications of data
- Standard syntax for naming data
- Suggested formats for data
- Approved abbreviations
- Guidelines for using standards and enforcing their use

As mentioned above, one component of data standardization is a standard syntax for naming and defining data. Data element naming standards are instrumental in fostering a common understanding of data throughout the University, promoting data sharing across systems and among data users by providing uniformity in how data is defined and named. At the U-M, standards for naming and defining data were the first component of data standards to be developed.

To illustrate how data standards can favorably impact an organization, consider the following scenarios:

Example A:

Without standards
Tuition charges have increased considerably. The new amount for medical students now exceeds the size of the original data element field. The database which stores this amount must be modified as well as all programs and files which use this data. Because there is not a standardized way to name data elements, each program must be analyzed and the data elements which contain the tuition amount identified in order for the size of the fields to be increased. The effort is intensive and takes several months.

With standards
The data element which contains the amount of tuition has been consistently named according to the standards. In all programs, files and the originating database the element name is TUITAMT. A global search and replace is carried out to increase the field size. The effort is completed in less than one week.

Example B:

Without Standards

A report is needed to identify all students who eventually become donors to the University. This report is to include the student/donor name, the date University degrees were conferred, the academic program of enrollment, and the total dollar amount of the gifts given in the last five years. The alumni/donor data, the student enrollment data, the student degree data, and the gift data must be merged. No data standards exist and each dataset contains dates which follow different formats. Conversion programs must be written to put the dates into a common format in order to merge the data. This process adds several weeks to the reporting effort.

With Standards

Data standards are adopted and enforced to ensure that all dates are represented in CCYY-MM-DD format. The query to produce the report can be written to join the date fields without converting the data. The report is produced in a timely fashion and the information proves invaluable to a major capital campaign.

Who Should Develop Standards?

At the U-M, University Information Systems (UIS) is a component of the InformationTechnology Division. UIS is responsible for developing and maintaining administrative systems. The Data Administration group within UIS is responsible for ensuring the establishment, maintenance, and delivery of stable, reliable, and accessible collections of institutional data in electronic form for shared access by the University community. Institutional data is defined as data that satisfies one or more of the following criteria:

- It is relevant to planning, managing, operating, or auditing a major administrative function of the University.
- It is referenced or required for use by more than one organizational unit. Data elements used internally by a single department or office are not typically part of the Institutional Database.
- It is included in an official University administrative report.
- It is used to derive an element that meets the criteria above.

Data standards facilitate the discovery of data which can be shared throughout the University and provide uniformity which enables the control and management of the University data resource. Thus, the development of data standards became a charge to Data Administration.

The Data Element Naming Standards Working Group (DENS)

To gather support for developing data standards and to formulate a plan for getting started, a proposal was drafted identifying the major tasks. This proposal requested representatives from areas within UIS to form the core working group to develop standards, with the Data Administration representative serving as the chair.

In October, 1991 the Data Element Naming Standards Working Group (DENS) met for the first time. The seven members were all senior level staff who had expertise in areas of systems development. These individuals were to be responsible for developing and promoting the standards. It was determined that customers and UIS staff would serve as the review audience for the standards the group proposed.

Incorporating Total Quality Management (TQM)

With the recent integration of Total Quality Management (TQM) into the Information Technology Division, it was decided that some of these concepts would be incorporated into the group, particularly the use of PAL, that every meeting should have a set purpose, agenda and time limits. Another TQM concept which was followed was the establishment of rules of conduct for the group. These rules of conduct were basic principles that the group members agreed were important to the success of the group's activities.

The rules of conduct became very instrumental to the success of the DENS group. As group members wearied of the tedious process for developing standards, and attendance at meetings began to falter, these basic principles were used to rally the troops. The group put pressure on individual members to participate and to attend, emphasizing the need for everyone to participate in the weekly discussions so that decisions did not need to be rehashed and redecided.

Determining a Charge

The DENS group agreed to meet weekly and the first task was to establish a charge. The group decided to focus on tangible deliverables which could be completed within a year.

> **DENS CHARGE**
>
> **Establish the University's Class Words.** Draft and submit for approval a list of major classifications of data, approved acronyms and abbreviations, definitions, data types and formats to be used in standardizing the University's data elements.
>
> **Develop Guidelines for Defining Data Elements.** Develop guidelines for defining data elements to be used by UIS staff and users when creating new datasets.
>
> **Establish a Syntax for Data Element Names.** Recommend a syntax to be used when naming logical and physical data elements.
>
> **Develop a Method for Educating Staff and Users about Standards and Guidelines and Enforcing their Use.** Recommend a method for incorporating data element naming standards into the current data element definition forms and a method for enforcing the use of the standards.

Interviews were held with UIS project coordinators to determine if formal or informal data standards already existed. Several internal UIS documents which addressed standards were reviewed as well. Many resources were used to provide background and guidelines for developing standards. The most valuable proved to be Arnold Barnett's All About Data Elements (1990). Many of Barnett's philosophies were incorporated into the standards developed for the U-M.

THE UNIVERSITY OF MICHIGAN'S DATA STANDARDS

Components of Data Element Naming Standards

The three major entities governed by data element naming standards are:

1. data element definitions, which consist of prime words, optional qualifiers, and class words;
2. logical data element names, which are derived from data element definitions;
3. and physical data element names, which are developed from logical data element names.

A data element definition is an English phrase (or phrases) which describes a data element. The definition should not be specific to an application. Instead, it should describe the data so that anyone in the University will be able to read and understand the meaning of the data. For example, the data element Organization Group Description has the following definition:

A textual description of the code assigned to each UM academic and administrative unit for the purposes of financial reporting.

A logical data element name uniquely identifies a data element within the University's data resource. An example of a logical data element name, derived from the above definition, is:

Organization Group Description

Finally, a physical data element name is the name required by operating software to identify data uniquely and manage it within program and system code. The University may establish several physical data element names for one logical name, depending on the language or database management systems in which the data element is used. One data element at the University may be given different physical names for use in PL/I, COBOL, DB2, Oracle, and IMS. Because these different environments impose different constraints, the physical names for the previous example could differ in length and format as follows:

ORGANIZATION_GROUP_DESCRIPTION	PL/I
ORGANIZATION-GROUP-DESCRIPTION	COBOL
OrgGrpDes	DB2, Oracle
OrgGrpDs	IMS

The Proposed Standards and Guidelines

Data element definitions, and logical and physical data element names all contain two or three basic components. It seems appropriate to name and explain these components before presenting the standards themselves. These basic components are prime words, class words, and optionally, qualifiers.

Prime words describe the subject area of data. At the U-M, prime words are being identified by Data Administration during strategic data planning and data modeling efforts. Below are some prime words that have already been identified:

Student
Funding
Course
Employee
Election
Organization
Account
Jobclass
Registration
Program
Degree
Appointment

Class words describe the major classifications of data associated with data elements. The DENS group developed a complete list of class words appropriate for use at the University. For each data element defined and named, one class word from the list becomes part of the data element definition and associated logical and physical names. Some examples of class words at U-M are:

Date
Number
Amount
Code
Name

Qualifiers further define and distinguish the prime and class words. The following are examples of qualifiers:

Last
Assessed
Starting
Status
Birth
Previous
Type
Beginning

When defining and naming data elements, one step of the process flows into the next. In order to follow data naming standards at U-M, a three-step progression is recommended. First define the data element, incorporating the appropriate class word, a prime word and qualifiers as needed. Then use that definition to develop the logical element name. Finally, use the logical element name to arrive at the physical element name, taking the name length and format constraints of the operating software into consideration.

Data Element Definitions

The following guidelines apply to the process of developing data element definitions at U-M:

a. The classification of data (class word) should be identified in the first part of the definition.
A code representing...
A name describing...

b. The definition should identify the associated entity (prime word).
The date of birth of an employee...
The starting time of a course...

c. The definition should consist of one or two statements which read clearly and concisely.

d. The definition should describe what the data is, not what it is not.

e. The definition should note if the data is derived from other data elements. If the data is derived, the associated algorithms should be included in the definition.

f. Ideally, the definition should describe the data fully, so that it is easily understandable to someone outside of the specific business area.

Logical Data Element Names

The next task to be addressed was to establish a syntax for naming data. The experts had conflicting opinions on the correct syntax to follow: class word - prime word - qualifiers; qualifiers - prime word - class word; prime word - qualifiers- class word; prime word - class word - qualifiers. At the U-M, the testing of real data proved to be the best approach to reach a decision. In order to test the data and determine the most intuitive syntax, the DENS group tapped into the energies of customers and systems staff who were working on a very successful project to provide administrative data to users in Oracle. Thus the Data Access Project became the proving grounds for the standards. The project consisted of three subgroups focused on delivering financial, personnel and student data in an environment conducive to ad hoc reporting. The Data Access Project provided an opportunity to test the standards in their infant stage and to incorporate valuable customer participation in the process.

After experimenting with different rules of syntax and applying them to many existing data elements, the DENS group concluded that the following syntax for logical data element names promotes element names that are most readable, intuitive and commonly understood:

Prime word -- required
Qualifiers -- optional
Class word -- required

Examples of logical element names which adhere to this syntax follow:

PRIME WORD	+	(QUALIFIERS or secondary PRIME WORDS)	+	CLASS WORD	=	LOGICAL DATA ELEMENT NAME
Student	+	Last	+	Name	=	Student Last Name
Account	+		+	Balance	=	Account Balance
Employee	+	Major Instructional Organization	+	Code	=	Employee Major Instructional Organization Code

A slight exception to this syntax is warranted in a very few cases: that of inserting a qualifier before the prime word to promote readability. For example:

(QUALIFIERS)	+	PRIME WORD or secondary PRIME WORDS)	+	(QUALIFIERS)	+	CLASS WORD	=	LOGICAL DATA ELEMENT NAME
Research	+	Account	+	Type	+	Code	=	Research Account Type Code
Next Higher	+	Organization	+		+	Code	=	Next Higher Organization Code

Physical Data Element Names

Physical data element names are developed from logical data element names, but because of limitations imposed by operating software of various types, the physical names may require the use of abbreviations and acronyms. The class words used at the U-M are accompanied by two- and three-character approved abbreviations, and prime words are being documented with standard abbreviations as well. In some very constrained environments, however, physical data element names may be so restricted in length that even the abbreviation may need to be shortened, or the class or prime word may need to be excluded from the physical name. In such cases, the standard naming syntax should be followed as closely as possible, employing the shortest abbreviations while still aiming for readability and completeness. When the operating system allows it, improved readability can be achieved by using a combination of upper and lower case in element names to distinguish the beginnings of component parts and/or by including underscores or hyphens between the parts.

The examples below illustrate the development of physical element names for different software environments and their differing constraints:

LOGICAL ELEMENT NAME	PHYSICAL ELEMENT NAMES			
	IMS	DB2/ORACLE	PL/I	COBOL
Student Last Name	StLstNm	StuLastNm	STU_LAST_NAME	STU-LAST-NAME

Account Balance	AcctBal	AcctBal	ACCT_BAL	ACCT-BAL
Employee Major Instructional Organization Code	MajInOrg	MajInstOrgCd	EMP_MAJ_INST_ORG_CODE	EMP-MAJ-INST-ORG-CODE

The University's Classifications of Data

Resources were tapped to provide sample lists of class words. The general recommendation was that the list should contain ten to fifteen classifications for the organization. The DENS group "tried on" the class words from the sample lists with data elements from many different University datasets. Most of the sample lists contained the class words *address* and *flag* or *indicator.* After much discussion, it was decided that address was a qualifier, and all of the component elements of an address would fit into one of the classifications already identified (e.g., State *Code*, Street Line *Text*, Country *Code*, etc.).

The *flag* or *indicator* classification proved to be a test of the consensus building techniques the DENS group followed. The words *flag* and *indicator* were interpreted to represent a binary relationship, either on or off, yes or no. Based on the members experiences in the trenches of systems development, they felt that no element ever remained completely binary, that eventually an additional value was added to the element, a "U" for unknown or an "X" for not applicable. Thus for the University's standards, an indicator became a ***code*** that indicates. This decision was reviewed several times, and the original arguments held. As the standards are being followed, there has been no disagreement with the original decision.

Class words group data into major classifications. At the U-M, the classifications are themselves divided into major categories:

Chronology -	Related to a point or span in time
Measurement -	Indicating dimension, capacity, amount, performance or duration
Identification -	Distinguishing a person or thing
Text -	Free-form or narrative in nature

The University's class word list contains the class words grouped by category. Definitions of each class word, recommended abbreviations, and several examples of data elements in each class are also included.

One of the first steps in defining and naming a data element involves consulting the class word list to choose the major classification to which the data element belongs. The selected class word then becomes an important part of the element's definition as well as a part of its logical and physical names.

Obstacles to Standardizing Data

Two of the main obstacles to standardizing data names and definitions stem from resistance to change and the limitations imposed by operating systems' constraints. At the U-M, many administrative departments have been dealing with the same data elements for years and have become comfortable with data names that are not intuitive or clear to an outsider. And when length and format restrictions result from choices of operating environment and coding language, many data users prefer to retain names that have grown meaningful to them over time, without regard for the fact that "their" data may be accessed by increasing numbers of casual users. In these cases, it is helpful to remind data users and system designers that in the trend toward distributed data processing and data sharing, no one office or department can consider itself the owner of data.

The following example characterizes these obstacles and how the Data Access Project proved that standards are crucial.

The Great Alpha Code Debate

The Data Access Project Financial Dataset Subgroup was ready to expand the initial set of corporate financial data to include additional tables and elements. The core elements had been selected and the tables developed using established data modeling techniques. The next step was to establish data element names and definitions for the expanded dataset.

The Data Administration analyst was working with the group to identify names and definitions which conformed to the developing standards. A data element which was fondly known as Alpha Code to the central financial office, became the impetus for determining how the standards would be applied and accepted. The alpha code identifies the sponsor or donor of funds of an account, and its alphabetic coding scheme is used for sequencing purposes. As the data analyst questioned the subgroup about the "true nature of the element," the central office representative emphatically proclaimed that, "everyone knows what an Alpha Code is!" The other subgroup members, representative business managers from schools and colleges and extensive users of financial data, promptly replied that, in fact, they had no idea what an Alpha Code was. The data element was defined and renamed Account Source Code by the subgroup. The decision was an acknowledgment of the benefits and need for naming standards.

Education and Promotion

In William Durrell's book, Data Administration, a Practical Guide to Successful Data Management, the seventh commandment of his *Ten Commandments of Data Standards (1985)*, proved to be an excellent complement to the TQM philosophy of "customer first." These concepts were incorporated into the DENS group's actions when it was time to promote the standards. Durrell's seventh commandment reads:

> Standards must be sold, not dictated. Even if upper management whole-heartedly supports Data Administration standards, the standards must be sold to employees at all levels. Data Administration must be willing to advertise the standards to all employees and to justify the need for such standards. Data Administration standards demand that programmers and analysts change the way they design data. Any lasting and meaningful change must come from the employees themselves.

Educating users and UIS staff about the standards and marketing the concept of standards became a two-pronged effort. Drafts of the standards document were distributed to all UIS employees and to key users for review and comment. Members of the DENS group made presentations, providing in-depth information about the use of standards and how they were developed, and answering questions and concerns. Reactions were generally positive and all comments and revision requests were documented and discussed within the DENS group. Many of the comments or questions could be addressed by reviewing the minutes of the group's earlier discussions.

A detailed education plan was developed and followed, specifically:

DENS Education Plan

- A technical bulletin was issued to announce the standards to UIS staff. Accompanying this technical bulletin was the DENS standards and a Question & Answer information sheet of most frequently asked questions about the standards.

- An announcement was made to UIS customers via The InformationTechnology Digest, published by the University's Information Technology Division.
- A segment on the DENS standards was included in the existing Data Administration overview class for UIS staff.
- UIS staff and customers working with Data Administration on developing new data elements received support from Data Administration in applying the standards either through formal data modeling sessions or informal discussions.
- UIS staff were encouraged to contact members of the DENS committee or Data Administration for interpretation/support in applying the standards.

But How Can Standards Be Enforced?

The DENS group was ready to focus on developing a method for enforcing the standards. The Documentation Library (DocLib), an area within UIS, was responsible for moving programs and systems to production and ensuring that existing conventions were being followed. The DENS group had assumed that the naming standards would be enforced at the same point. The group also understood the necessity of avoiding bottlenecks which would frustrate customers and staff trying to follow the standards. Another TQM concept, management by facts, was put into operation.

A representative from DocLib gathered information regarding the number of data elements which had been defined or named using the current method and forms for entry into UCC10, the University's data dictionary for IMS data elements. Six months of UCC10 activity was studied and it was determined that fewer than a dozen data elements had been named or defined through the conventional method. It was determined that the existing standards for documenting new data elements were not being followed, as programmers and analysts were pressured to move systems to production as quickly as possible.

If the standards were enforced at this point, a bottleneck was unavoidable and the enforcement was destined to fail. The group interviewed additional UIS staff to determine a method of enforcement that could succeed. The DENS recommendation for enforcement was to educate and to encourage proactive involvement in naming and defining data by Data Administration.

DENS Recommendation for Enforcing Data Standards:

- In order to promote consistency in naming and defining data it is imperative that Data Administration be involved in the development process. Recognizing that resource and time constraints will prevent this involvement in all application projects, the standards should be understood and their use encouraged by managers and their staff who oversee projects.
- By enforcing the U-M's Systems Development Methodology, data will be named and defined consistently and according to standards. It is inappropriate for naming standards to be enforced within the move-to-production process. Enforcement at this point would be ill-timed and cause delays in project implementation. If Data Administration is involved in the development process, data will be named and defined consistently up front, prior to programs being written.

SUMMARY

At the U-M over the course of a year, data naming standards were successfully developed and implemented, thanks to the efforts of many interested people. To begin, a Data Administration representative, already versed in the areas of data administration and data naming, requested the help of experienced staff from various areas of UIS. A small group was formed to perform the bulk of the work. This DENS group applied TQM techniques from the outset; first, as it proceeded to gain familiarity with the concepts and terms used in data names and definitions, and later as it focused on its charge and developed the components of data naming standards that fit the University environment. When formulating the U-M naming standards, DENS group members tested the standards against real data elements and introduced them to customers collaborating with them on current projects, both to see how well the standards worked and to learn how easy they were to use.

Even after several iterations of the standards were tested and reworked, the DENS group sought more customer and programmer feedback. The standards were documented, explained and distributed, and comments on the standards document were solicited from UIS managers and programming staff and from a number of U-M customer groups. As the DENS group awaited comments from programmers and customers, it continued to work on the remaining aspects of the standards effort, education and enforcement.

The DENS education plan was multi-faceted. It included the standards document in its final form accompanied by a Question & Answer information sheet, a newsletter announcement, and incorporation into the Data Administration overview class. Data Administration staff continue the education process begun by DENS as they work with customers, analysts, and programmers in formal data modeling sessions or informal design discussions. Responsibility for enforcement of data naming standards falls to Data Administration staff as well. Their ongoing efforts early in a project's life cycle, identifying and naming applicable data elements, almost eliminate the need for rigid enforcement of the standards. Because the standards make it easier to name and define data elements, and because Data Administration works with project developers, the enforcement process practically takes care of itself.

Since the U-M naming standards have been formalized and distributed, Data Administration has been contacted by other University units requesting copies of the DENS document for use in developing departmental systems. The DENS final report encouraged further development of standards for table names, views and synonyms, and the report also recommended that the DENS group reconvene at periodic intervals to review proposed changes to the existing standards.

Throughout the process of developing standards, the DENS group focused on the basis for the standards themselves: to promote data consistency, to reduce redundancy, and to make data readily understandable. At the same time, the group acknowledged that the full benefit of data standards would not be realized until a University-wide data dictionary or repository was in place. The implementation of a repository will certainly impact the standards that the University has adopted. In the interim, data is being named and defined more consistently, and UIS staff and customers better understand the need for standards.

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TRACK V

MANAGING NETWORKING AND TELECOMMUNICATIONS

Coordinator: Clifford Woodruff

The convergence of data, voice, image, and video technologies makes the management of their delivery mechanisms one of the most critical information processing resources. Papers in this track explore experiences dealing with complex telecommunications issues in colleges and universities.

Data Does Networking!

by
Gene T. Sherron, D.B.A.
Professor of Information Studies
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ABSTRACT

Since the beginning of computing back in the '50s, we've been *doing data*. But my, have times changed! Today, data moves at 100 megabits (Whatever that is!) and everybody is doing his own LANs. Driven by the garage-born micro, the users are extending the power of computing into the workplace by doing much of their own "networking" with a child-like faith that they ought to be able to *do data* as easily as making phone calls. Well, why not?

The purpose of this paper is to present current information, in layman's terms, about networking and data communications--the range of options open to us and indications of what campuses are doing with this communications technology. It is not designed as a techie paper.

In January 1990, CAUSE published a voice communications professional paper entitled *An Information Technology Manager's Guide to Campus Phone Operations.* In some respects this is a "sequel" except for the fact that it is **data**-oriented. So, look to learn about topology, media, compatability, LAN software, and like stuff. Experts need not attend!

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I. INTRODUCTION

Networking in the Latter Years of the Information Age.

It has been a long-standing need of man to communicate. Forget the drums, bonfires, semaphores, and flashing mirrors of years gone bye. Today, managers rely on phones as the prime instruments for communications. They are simple, fast, ubiquitous, and geographically boundless. Yet, depending on which statistic you wish to accept, somewhere between 50 and 90 percent of business phone calls go unanswered on the first try. This annoyance, plus a general interest in reducing paperwork, has caused all sorts of people to be eager to try electronic mail (e-mail). Its acceptance is making it second only to the phone as essential office equipment. By the way, does it register in our minds that FAXing is electronic mail?

And even today, few people understand all of the technical aspects of connecting people electronically, but managers know what they want--"everything is connected to everything."[1] Yet, it is one thing for the president to tell us to get connected, and quite another to be implemented. So, how do we get our arms around these issues? Perhaps, what we need is a quick cram course on e-mail and its associated technology. The techie stuff includes such things as local area networks (LANs) to hook-up the offices and the software (operating systems and protocols) to drive these systems. Thus, we end up with a bit more on our plate, but at least a half a dozen topics are critical to our understanding of LANs, networking, and data communications.

II. NETWORKING

Some defining--Doing some networking? Whether we call it *networking* or *local area networks* (LANs), selecting the scheme for your campus is no simple task. Today's networking/LAN marketplace is crowded with at least fifty different vendors, all claiming that their product is THE one you need. Further confusion occurs because there are few standards in networking, de facto or otherwise. Nonetheless, you may be sure that the simple, small LAN you install today will turn into a large, multifloor, multibuilding, or multicampus network in the not too distant future.

In terms of size, the network will only *grow*. The multivendor approach will likely become more *multi*. The applications we run across the network will continue to vary in *diversity*. And, the *unpredictable* usage will be the norm.

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[1] John F. Akers, President of IBM, Communications (Chicago: Time-Life Books, 1986), p. 8.

In a formal sense, a *network* is one or more communications circuits and associated equipment that establish connections between nodes (users).[2] (Unfortunately, you'll have to wait until later in the paper to fully appreciate some of the words in this definition.) In terms of the technology that makes a *local area network*, it can be said that a LAN consists of some hardware, software, cabling, and connectors. The *hardware* is typically a PC and some added internal electronics. The *software* comes to us from dozens of vendors that provide a LAN operating system and applications software products. The *cabling* can be twisted pairs, coax, and/or fiber. And, *connectors*-- such as interface cards, transceivers, and cable connectors--provide the linkages between the nodes and the medium.

LANs have proven their value in organizations that range in size from small offices to far flung university campuses. By definition, most *local* area networks connect users within a single building. Yet, as they become more and more popular in an organization, LANs expand to adjacent buildings. And before you know it, connections are needed beyond the LAN to a city or metropolitan area network (MAN) or even to national and international networks or wide area networks (WANs).

Rational behind LANs--A well-designed LAN can deliver many important benefits. First, it allows users to share organizational resources such as databases, graphic devices, high-speed laser printers, and mass storage devices. Such sharing can increase the use of scarce resources, improve individual productivity, and promote efficiency. It might even allow us to place less emphasis on making and filing paper copies and, as attitudes change, may even reduce intraoffice paperwork. Now, let's get into the details.

III. TOPOLOGY

As networking progressed, it became evident that names would have to be given to the different methods of getting all these users wired together. You'll hear people refer to these grand designs as *network architecture*, or the more functional title of *network topology*, or *cabling configurations--as some prefer*.

More frequently, people like the phrase *wiring topologies*, so that will be our title for this section. The basic topologies are: *bus*, *ring*, and *star*. However, in practice, we find a number of wiring schemes that are mixtures of these basic topologies.

Networks with the *bus* topology sometimes are called backbone networks because they connect each device to a central cable called the *backbone*.

IV. MEDIA

Our LAN's electronic transmissions move over highways of *cables*. These cables are the different media. We usually think of cabling as copper wires, but more recently, glass (optical fiber), is gaining popularity as a LAN medium.

LANs are typically cabled with copper and it comes in many varieties. But, one observation at the outset: There is no one best cable for LANs!. As suggested earlier, the medium for your campus may be a matter of historical consequence or thoughtfully chosen, based on present and long-term requirements for data, text, graphics, voice, image, and video.

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[2] Stanford H. Rowe, II, Business Telecommunications, 2nd ed., (New York: Macmillian Publishing Company, 1991), p. 365.

Media selection is a very important aspect of LAN development. If you choose incorrectly, the LAN may not be able to support future loads or may introduce reliability problems. Some of us get "stuck" with an existing cable plant that would cost millions to dig-up and replace. This wire that stretches from the wiring closet to the end user, or the horizontal wiring, represents about 85 percent of the cost of any rewiring program. So, with so much of it already in place for the phone system, you can bet that *unshielded, twisted-pair copper* will remain the horizontal medium of choice during the coming years.

V. NETWORKING STANDARDS

The Need for Standards--Back in the 1950s there were no rules, let alone standards, for data to be communicated. In fact, the need for one computer to talk to another computer just did not exist. But, over the years and decades, networks and telecommunications systems evolved, people in the business realized that each system should continue to be unique and specially developed.

LAN Standards (The 802 Committee)--Because our LANs tend to spill over into national and international networks, several professional organizations have initiated efforts to standardize various aspects of networking. The work of the Institute of Electrical and Electronics Engineers (IEEE) 802 Committee is the best known for LAN standardization efforts. Since it was founded in 1980, the 802 Committee has approved a standard family for LANs and established several different network access protocols. A few of the more significant ones are highlighted below:

1. 802.3 CSMA/CD and Ethernet

This standard addresses a variety of CSMA/CD architectures that are generally based on *Ethernet*. One of the early subcommittees, it began with 1BaseT and is progressively working on other developments:

1BaseT -- The early one is referred to as *1Base5,* which means 1 Mbps across a baseband medium with a maximum length of 500 meters. This standard encompasses the more commonly known implementation named *Starlan* by AT&T.

10Base2 -- Gaining recent popularity is *Thinnet* or *Cheapernet,* or a 10 Mbps baseband segment of up to 200 meters.

10BaseT -- The renaissance of *copper twisted pairs* has been sparked by this standard of 10 Mbps baseband signals.

2. 802.5 Token Ring

Token-Ring is IBM's LAN methodology which features a single, baseband ring topology. It operates over twisted pairs, but can accommodate more PCs if data-grade cabling (coax or fiber) is used. IBM began its token-ring running at a speed of 4 Mbps. Today, you can buy either
4 Mbps or 16 Mbps Token-Ring. Shielded twisted pair (STP) type cable is the most robust installation and is preferred for all new rings. However, many cable manufacturers insist that
16 Mbps run just fine over unshielded twisted pair (UTP).

A Standard Interconnection--Internationally, in order to facilitate linking systems, a model was developed the *International Standards Organization (ISO)* which, along with several telecommunications vendors and CCITT, that became known as *open systems interconnection (OSI) reference model.* Since 1978, work has been underway to convert the model into a set of standards by precisely defining each part of the layers of the model. The architects of the ISO-OSI model had as their primary objective to provide a basis for interconnecting dissimilar systems for information interchange. The idea being, if they defined the rules or protocols of communication, and if followed, incompatible systems made by different manufacturers would be able to "talk" to each other. As open systems have risen to the forefront in networking, standards are currently evolving from two directions *Open Systems Interconnection (OSI)* and *Internet.*

The Open Systems Interconnection Model

CCITT X.200 is the designation for *Open Systems Interconnection* (OSI) which is referred to as the Basic Reference Model for open-systems type of networking architecture. Announced in 1978, the OSI model uses a layered approach, with each layer representing a component of the total process of communicating. One way to view this model is view hardware on the bottom or layer 1. At the top is software or layer 7. In between are varying amounts of each. All of the layers in-between describe the standards that handle the necessary elements of control.

The bottom three layers--Physical Link, Data Link, and Network Control--of the OSI model are well-defined. Standards have been written and agreed to. The combination of the first three layers is the *X.25* standard for data transmission used in *packet switching* networks. As one moves on up the scale of the layers, the complexity seems to grow. Many standards are required to address all of these areas and the work will go on for years.

Future Directions--With less than two percent market penetration, OSI's future does not appear bright. Adopting certain parts of OSI will provide added value to users; and for some even full OSI implementation will be of value. The lower layers of the OSI model have provided for better multi-vendor connectivity and internetworking. And such standards as X.400--the *de facto* standard for electronic mail--and the emerging X.500 may become THE standard for directory services.

VI. LAN ARCHITECTURES

Ethernet--As discussed earlier, *Ethernet,* is one of the three oldest architectures--token bus, token ring, and Ethernet. The original implementation was with coax or thick Ethernet. Today, in addition to shielded "thick" coax, which supports devices up to 500 meters, *Thinnet* or *Cheapernet* coax is about half the size of regular coax. However, it reaches out only about 185 meters. The two sizes of coax offer the advantage of using thick coax for a backbone application, with "skinny" coax being used as spurs to buildings. Still the dominant LAN architecture, Ethernet's growth is directly tied to the price of adapter cards (network interface cards) which has run at 40 percent a year for several years.

AppleTalk--Second in popularity in campus LAN architecture, *AppleTalk* is increasing in numbers in the workplace. To facilitate this occurrence, Apple builds its

Macs with internal network interface cards and the software to support what it calls *AppleTalk*. Using either Apple-provided *twisted pairs* or coax, this unique "standard" supports up to 32 Macs or printers at a relatively slow speed of 230 Kbps. Designed with a CSMA/CD type of access protocol, its workstations can be arranged in a *bus* or *star* configuration. Interfaces also exist that allow Macs to connect to LANs having IBM PCs or clones.

Token-Ring--Growing almost as fast as Ethernet, IBM's LAN product is *token-ring*. It dominates market share in the sale of IBM token-ring adapter cards. These cards generally conform with IEEE 802.5 using *baseband* transmission on either shielded or unshielded twisted pairs. A network interface card (NIC) is used to connect the workstation to the token ring on one end. A multi-station access unit (MAU) is used to interconnect 4, 6, or 16 users to the network.

ARCnet--As mentioned earlier, *ARCnet* was developed to connect minicomputers. It uses a *token passing bus or star* architecture but does not conform with the IEEE 802.4 standard. The reason is simple. It came in to being almost a decade before standards were even developed. ARCnet is one of the more popular LANs because of its early availability for PC-based LANs, relative low cost, flexibility, and well-recognized *de facto* standard.

Starlan--*Starlan* has been standardized by the IEEE 802.3 subcommittee under the 1Base5 standard. Using the CSMA/CD access protocol, it can support an unspecified number of nodes on a cable up to 500 meters long. Starlan is an AT&T methodology, star-oriented, and provides
1 Mbps speed. One early advantage of Starlan is that the scheme uses plain old twisted-pair telephone lines that are already in most buildings. Also, it uses the CSMA/CD scheme and accepts multiple operating systems to include MS-DOS and UNIX.

Future Directions--One need not look too far to find evidence of the effect that *unshielded twisted pairs of copper* has had on the LAN marketplace. Recent market reports show that over 60 percent of all new *Ethernet* sales are using UTP cable. Imagine, over 6 million Ethernet connections will be made this year. The *10BaseT* standard has worked its way ahead of *Token Ring* with price driving the buying decision. 10BaseT can be purchased for approximately $275 per port, compared to $500 to $700 per port for Token Ring.[3]

FDDI networks operating over copper or *Copper Distributed Data Interface (CDDI)* at 100 Mbps are predicted to throw traditional Ethernet and Token Ring networks from their current leading market position by 1997. Spurring the takeover are faster PCs and resource-hungry applications such as imaging and full-motion video. The acceptance of copper versus fiber is a matter that it is cheaper, and most people already have lots of copper. At issue is how long it will take the American National Standards Institute (ANSI), which has been working for copper standards since mid-1990, to provide an ANSI-standard for product development. Expect it in 1993.[4]

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[3] Gary A. Howard & Frank X. Mara, "Design a Copper Network for PDS and LANs Using UTP," Cabling Business, October 1992, p.10.

VII. LAN OPERATING SYSTEMS

The issue in systems management in LANs is that of determining what level of service is required/desired. That is, do we need a network for occasional e-mail use, or are we dealing with more complex database management processes and need tightly coupled overall control because the applications span many departments and machines? In either case, we need to meet the range of user needs in a cost-effective manner.

Over the past decade or so of growing complexity in networking, users have quietly hoped for network control that doesn't appear to "control." But rest assured, the more usage and users, the more control will be needed. A *LAN*, or *network operating system (NOS)*, provides a certain transparent "manager" of the system's resources.

Novell's NetWare--The dominant leader in the NOS business is Novell's *NetWare*. Novell offers at least seven network operating systems (NOSs), as well as custom server hardware on which those NOSs run. Five of these run on IBM/IBM-compatible systems, one is for Macintoshes, and one for DEC VAX systems. One significant feature of Novell is its *system fault tolerance (SFT)* that provides an environment in which, if certain hardware failures occur, the network does not necessarily go down. For almost two years, IBM has been selling "NetWare for IBM" which gives users a Big Blue direction for now.

Banyan Vines--Banyan *Vines* is recognized for its support for large networks and network interconnections. One of the very few to run on Unix-based servers, Banyan has a distinct advantage in the market place because many WANs contain nodes that run *Unix* operating systems. Few can match Banyan's multi-user, Unix-based machines support.

IBM's LAN Server & OS/2--Although slow in coming, it appears that IBM wants you to do your data communications, multi-tasking, and presentation services via its latest versions of IBM's operating system or *OS/2*. So, mark *LAN Server* "out" and *OS/2* as "in." However, IBM versions support only IBM token rings, not IEEE standards. An *extended OS/2* version has enhanced capabilities such as the *LAN Server* and a communications manager.

Microsoft's LAN Manager--In 1991, we noted that Microsoft was failing to resuscitate *LAN Manager*. This year it is apparent that the Microsoft emphasis is on *Windows Workgroups and NT*. Whether these products will or can take a bite out of Novell's huge market share will be based on market acceptance of these new products.

3COM's 3+ & 3+OPEN--Founded by the inventor of Ethernet, *3Com* has been a leader in LANs from its very beginning. The latest 3Com offering, *LAN Manager*, runs under Microsoft's OS/2. 3Com's *3+Open* is the OS/2-LAN Manager product sold directly by 3Com. Microsoft also provides its own version of LAN Manager. 3+Open goes beyond just supporting Ethernet and handles token ring architecture as well. Like Novell, LAN Manager provides fault tolerance via mirrored disk drives. And, like Banyan Vines, 3Com has announced a name directory service.

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[4] Lynda Radosevich, "FDDI Over Copper Will Shake Down Ethernet," Computerworld, October 26, 1992, p. 50.

DEC's Pathworks--For years, DEC has offered its own NOS, but competition has been stiff. Consequently, Digital has quietly introduced a product called *Pathworks* that walks the fine line between a NOS and DECnet. *Pathworks* ties into high-level services provided by DECnet and builds bridges to other PC-focused NOSs such as Novell's *NetWare*, Banyan's *Vines*, and 3Com's *3+Open*.

Using client and server software, *Pathworks* accomplishes this balancing act on the client side with PCs, Macs, and ULTRIX users getting basic mail application, network transport software, terminal emulation, and VMS application support. Server software provides users with print, file and mail services and support for TCP/IP, DECnet, and OSI. And, the server can be VMS, UNIX, or OS/2 based. The Digital strategy with *Pathworks* is to provide a corporate NOS to integrate all popular LAN technology and support all standards.[5]

Future Directions--Have you considered that the lines between *general-purpose operating systems*, such as DOS, Apple's System 7, and OS/2, and *network operating systems*, such as Microsoft's Windows Workgroups, are blurring as each acquires attributes of the other? As the number of LAN-connected PCs rises along with the network-intrinsic applications, the division between operating systems and networking operating systems is becoming less and less. Perhaps, by the year 2000, we will have merged OS and NOS!

VIII. PEER-TO-PEER LAN OPERATING SYSTEMS

Peer-to-peer networking enables users to share files and printers without a file server. Products to serve this market have been provided by about a dozen vendors for years. For a number of years, LANtastic, 10Net, Web, and TOPS have been the bread-and-butter lines for peer-to-peer networking.

Apple's *System 7* was the first major vendor to make peer networking capabilities inherent in an operating system. Novell recently jumped into the peer networking bandwagon with *NetWare Lite*, a low-end, peer-to-peer version of its flagship server-based NetWare NOS. In late 1992, Microsoft became the newest player to enter this market with its built-in peer networking capabilities in *Windows for Workgroups*.

Critics are quick to point out that Microsoft is not providing another peer network operating system but merely adding simple file and print capabilities to Windows. Additionally, it does not support any "clients" except Window's clients. In contrast, all major peer NOSs support DOS, Windows, OS/2, and Apple's Macintosh. However, for current Windows users, upgrading to Workgroups may be a good step.[6]

IX. NETWORK-TO-NETWORK CONNECTIONS

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[5] Kimberly Patch, "Digital's New Path for Pathworks," Datamation, June 1, 1992, pp. 73-76.

[6] Caryn Gillooly, "Microsoft Marches Into Peer Net Market," Network World, November 2, 1992.

Transmission Control Protocol/Internet Protocol (TCP/IP)--In the 1970s, *Transmission Control Protocol/Internet Protocol (TCP/IP)* was developed by ARPA to connect incompatible computers used by military suppliers and researchers. It is a set of protocols that are compatible with the ISO/OSI reference model.

Today, *TCP/IP* is emerging as the protocol of choice for interconnecting LANs. And, it has achieved the promise of *open systems* as today's *de facto* standard for open networking.[7] Often referred to as the *TCP/IP suite of protocols*, the suite comprise a set of protocols that define a variety of network applications, for example, file transfer and virtual terminals.

While NetWare has a dominant position in the LAN-server marketplace, TCP/IP is the *de facto* standard for internetworking between diverse computing systems. One needs to consider interoperability implications between the choices of TCP/IP protocol and NetWare's IPX/SPX communications environment to appreciate the magnitude of this problem.

Repeaters--A *repeater* is used when a cable needs to be extended beyond its recommended maximum length. Because the signal becomes weakened the further it travels, a repeater is employed to amplify and retransmit the signal.

Bridges--A *bridge* is a device that can link two or more LANs to form one extended LAN that can span many miles. Bridges eliminate the distance restrictions and maximum-number-of-stations limit of LANs In addition, bridges act as packet filters and forward data that is intended only for remote LANs. Locally destined data remains local.

Gateways--A module, or set of modules, that transforms the conventions of one network into the conventions of another (a gizmo that allows you connect one person's LAN with a different type of LAN). A gateway acts as a language translator and allows two disparate networks operating under different protocols to communicate.

Routers--A *router* is used in internets (between networks) where more selective decision-making intelligence is required to select the most efficient path for the "data's" intended destination. It ensures faster traffic flow and can automatically provide for detours if a connection is broken along the path.

Brouters--Synchronous line bridges, or *brouters*, forward packets from one LAN to another across bandwidths up to 2 Mbps. It is invisible to most protocols, so the entire extended LAN looks like one LAN.

Hubs--To wrap up this section, a few words about *hubs*. Hubs range from simple, passive devices at the low-end to multifunction devices that include integrated bridging and routing at the high-end. To qualify as a hub, it must be capable of receiving a data signal and repeating it simultaneously to multiple wires through connections call "ports."

Future Directions--The latest happenings in the internetworking area is what is going on with *hubs*. Price cutting is crating a buyer's market at the low end, while vendors focus on advanced features at the high end. Hewlett-Packard, 3Com, and Ungermann-Bass have cut prices such that cost per port is in the $100 to $200 range, with many offerings favoring the lower price. With 70 percent of the Fortune 500 companies using both Ethernet and token-ring networks, the vendors have responded with 10BaseT, low-cost hubs. Many vendors are incorporating bridging and routing modules into their hubs rather than require customers to by separate units. In terms of media, all major media choices are covered in today's product offerings. And, *Simple Network Management Protocol (SNMP)* has pretty much become the *de facto* standard for hub management. To describe its operation, in simple terms, SNMP agents capture device and network information and forward that data to conveniently located SNMP management stations for processing and display. Although it is greatly criticized as a light-weight protocol, it is easily implemented and requires the minimum resources to operate.[8]

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[7] Marshall T. Rose, "Network Management is Simple: You Just Need the 'Right' Framework!" Integrated Network Management, II, (New York: Elsevier Science Publishers, 1991), pp. 9-23.

One of the hottest topics in today's LAN hub discussions is *asynchronous transfer mode (ATM)*. Utilizing 53-byte fixed-cell relay transport technology, ATM is a transfer mode for switching and transmission that efficiently and flexibly organizes information into cells. It can be used in both LANs and WANs to provide high-speed (150 Mbps+) seamless integration of wide-area, campus, and desktop-LAN transport. But, for now ATM is a "future" technology. Over the next several years, expect Ethernet, token-ring, and FDDI to continue to dominate communications to the network users.

X. CLOSING THOUGHTS

The economic proof of the value of adopting and sticking to a certain *LAN architecture* is desirable but often difficult to illustrate. Typically, each campus unit seeks to install a network at the lowest possible cost. However, the sum of these unit costs often add up to a sum greater than the whole. If we end up with *separate* and *not interoperable* or *adaptable* LANs, the campus can lose out. "*LANarchy*" costs big bucks through lost opportunities.

In closing, let us consider, "What makes networking successful?" There is downsizing, restructuring, and destructing going on everywhere. One thing is constant--*people* make systems work!

First, no matter where "networking" is located in your organization, one needs to give the *networking techie* the executive clout to carry out this important function. Secondly, the more direct the line from that *networking guru* to the organization's top technologist or manager, the greater the possibility of successful networking.

Nationally, there are over one hundred network users for every technical support person. And, when we think of their typical day, most of their time putting out "fires" and the rest of the catching their breaths. Operating in crisis mode, we need to help the networking staff to make time to grow and develop their skills and abilities. Unless we help them grow in breadth and depth, job hopping will occur. One day, we might just develop structure and positions so networkers will have normal patterns of promotion and career-pathing. We are all too familiar with the saying that can be adapted to our networking staff. "Techies do not necessarily managers make." So, as we work to develop good networks, let us adopt the slogan--"support your local techie!" People DO make a difference!

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[8] Salvatore Salamone, "The Hubbub About Hubs," Network World, June 1, 1992, pp. 47-50.

"We'll Support It—If You Can Agree:" Universal E-Mail at the University of Pennsylvania

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In highly decentralized universities where substantial computing services are provided by the schools, a major challenge for a central computing organization is getting the schools to agree on a software and hardware portfolio that is both limited and supportable. From the schools' point of view, the challenge is to provide the specialized services their clients need while pressing for central support that is of necessity more generic. From the schools' point of view, in fact, a better title for this presentation is "If We Can Agree ...You'll Have to Support It." The University of Pennsylvania's journey toward universal electronic mail for faculty, students, and staff offers technical, political, and organizational insights for decentralized institutions and others faced with negotiating agreements across diverse constituencies. What started as a task force to explore the feasibility of a common e-mail offering for undergraduates became a lightning rod and forcing function for other campus-wide issues, including the role of the network, the relationship of central computing to the schools, and the contrast in perspective between large, technologically sophisticated schools and smaller ones.

"We'll Support It—If You Can Agree:" Universal E-Mail at the University of Pennsylvania

In decentralized universities where substantial computing services are provided by the schools, a major challenge for a central computing organization is getting the schools to agree on a software and hardware portfolio that is both limited and supportable. From the schools' point of view, the challenge is to provide the specialized services their clients need while pressing for central support that is of necessity more generic. This presentation focuses on negotiating electronic mail standards and support in a radically decentralized institution like the University of Pennsylvania, where schools and centers control their own investments in information technology.

Your institution may not be as decentralized as Penn. With industry trends toward distributed computing and with the inability of central organizations to meet ever expanding need, however, you may find yourselves with increasingly independent local organizations with the finances and expertise to go their own way. It's important to look for opportunities for synergy.

In negotiating standards at the University of Pennsylvania, we find ourselves thinking of Penn's founder, Benjamin Franklin. As usual, Franklin sees both sides of the issue:

> *Neither a borrower nor a lender be....*

points to the value of Penn's twelve schools' independence, while

> *We must indeed all hang together, or,*
> *most assuredly, we shall all hang separately....*

captures the need for cooperation in the face of technological challenges and constrained resources.

In this presentation, we describe the e-mail situation at Penn, the bargain we struck, the year-long task force activity, some of the outcomes, and, most importantly, the technical, political, and organizational lessons we learned.

The Forcing Factor and the Bargain

When the story began a little over a year and a half ago, e-mail was well established in some Penn schools and most administrative units. In a patchwork of host- and local-area-network-based services, PROFS was deployed by Arts and Sciences; All-in-1 by Wharton, the Medical School, and central administration; UNIX Mail by Engineering; and QuickMail, Pegasus, and several other systems were emerging. Interoperability was a problem for everyone and keeping all the gateways working was a real effort for the central computing organization, Information Systems and Computing (ISC).

At that point, the School of Arts and Sciences announced its intention to offer e-mail to all 10,000 undergraduate and graduate students. This forcing factor triggered a series of events. The "big three" undergraduate schools—Arts and Sciences, Wharton, and Engineering—decided to seek a common e-mail system, given the high cross-registration among Penn's four undergraduate schools.

The "big three" approached the central computing organization to discuss, at a minimum, impact on the central modem pool and to explore possibilities for working together. One thing led to another, the schools put some pressure on central computing (a more accurate title for this presentation might be "If We Can Agree, You'll Have to Support It") and the Vice Provost for Information Systems and Computing struck a deal. He offered basic support from the central networking and end-user support groups if the schools could agree on a common e-mail solution. The schools would continue to finance, operate, and administer their e-mail systems.

Vehicles, Strategies, and Outcomes

On that optimistic note, a campus-wide task force was launched. The fourth undergraduate school—Nursing, which did not offer e-mail at the time—was drawn into the discussion. Task force scope and membership quickly expanded beyond the initial goal of a common e-mail solution for undergraduates. Electronic bulletin board service (NetNews), the task force decided, would greatly enhance the academic potential of e-mail. Task Force membership expanded to include all of Penn's graduate and professional schools, some of whom observed for a few meetings and decided that e-mail was not a priority this year for their school.

With Arts and Sciences already committed to offering e-mail to its 10,000 students, the objective of the task force was not to decide *whether* common e-mail is feasible, but to figure out *how* to minimize costs and make it work. The group investigated first- and second-order impacts of campus-wide e-mail in a place as large as the University of Pennsylvania, with 21,000 students and 20,000 faculty and staff. Three challenges dominated the weekly discussions and more frequent e-mail exchanges:

- Identify a low-cost, supportable e-mail standard to replace the numerous systems proliferating at Penn
- Articulate school and central support services to handle a 100% increase in the number of e-mail users on campus
- Avoid overcrowding in student computer labs, many of which are at capacity during peak times in the semester.

Strategy and agreements. The task force adopted a two-level strategy—a client-server Post Office Protocol (POP) approach over the long term and for those who already have the necessary IP connections—with the UNIX host-based ELM system as an interim solution. E-mail is most valuable when a critical mass of people have it. ELM would serve the large group that currently lacks IP connections. POP—with its friendly desktop client interfaces—would be available to those who could take advantage of it.

Two public domain e-mail software products, ELM and Eudora (POP for IP-connected Macintoshes) were endorsed. A DOS version of Eudora is expected to be released soon. Some schools will operate their own ELM and Eudora servers, while others will buy "retail" services from the central computing organization.[1]

Once basic direction was set, the task force split into working groups—a POP group, an ELM group, and a small schools group. The ELM group met its goal of deploying a common version of ELM within six months. They selected standard ELM (for feature richness), the PICO editor (for ease of use), and default settings that would create a consistent interface and allow one set of documentation to serve campus-wide. Support staff from several schools worked together to develop reference cards and video training and the central publications group developed a users' guide. The central networking group modified ELM and Eudora to access Penn's online electronic mail directory. Issues of modem capacity and modifications to the online directory database were referred to the parent task force.[2]

The small schools group investigated options for providing e-mail in small schools and came up with decisions ranging from "wait and see" to putting up 100 ELM accounts on a first-come-first-served basis. E-mail, however, turned out not to be the real point of the small schools group:

> *To me what's important about the group is not mail. Mail is an example of something—how do you handle support when you have such a small budget and almost no staff?*
> —Member of small schools group

The small schools joined the task force in the first place to investigate e-mail and see how pervasive it was going to be. If every other student on campus were going to have e-mail, the small schools would have to find a way to provide it also. Above all, the small schools were looking for political leverage with their own deans, strategies to convince their deans to devote resources to computing initiatives like e-mail. Central computing began treating the small schools group as a customer focus group. Here were people with very small budgets, very few staff members, no critical mass, and deans who were not entirely convinced of the value of computing. We asked all kinds of questions. The group gave patient, thoughtful feedback, which we tried to repay with information and introductions to people who were useful to know. The members treated the group as a place to share expertise, resources, and strategies for doing more with less; a place to get information, make their voices heard, and make contacts. We ended up with a friendly, active interest group that will continue—by explicit choice—after the other e-mail working groups have disbanded.

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[1] Details of the e-mail service offerings are available in Daniel Updegrove's article, "E-Mail at Penn," *PennPrintout*, Volume 9:2, October, 1992, published by the Office of Information Systems and Computing, University of Pennsylvania.

[2] A useful discussion group on technical and other aspects of electronic mail is the list serve *cw-email@tecmtyvm.bitnet* or *cw-email@tecmtyvm.mty.itesm.mx*.

Lessons Learned

We learned lessons about e-mail, the process, and each other.

E-mail a vehicle We learned that electronic messaging may not be the main benefit of a campus-wide e-mail initiative. E-mail is a vehicle to take fuller advantage of the network. Once you have a network connection for e-mail, you have access to the vast riches of the Internet.

Offer an early carrot. We believe the Vice Provost's early offer, "We'll support it, if you can agree," was crucial. The task force had a clear goal; the carrot was there for all to see.

Allow the bargain to evolve. The Vice Provost's offer turned out to be naive; we didn't agree on a *single* e-mail system, and support was shared across the University. The task force allowed the bargain to evolve, however, as the situation evolved.

It takes an issue to pull people in. The small schools say they would probably not have joined a generic small schools interest group, although they are more than happy to continue as one. It took an issue to bring them together.

Match group structure to life cycle of problem. In hindsight, we see that we mapped the structure of the group to the life cycle of the problem. The main group explored and focused the problem and then let go, turning the problem over to the working groups at just about the right time—not too soon, not too late. The working groups kept in touch via e-mail. Any member could receive agendas and minutes of any other group and participate in online discussions.

Get past the purists. Management turnover in the central user-support organization put central hotline support commitments in question until a new director could be hired. While some members of the ELM working group wanted to wait for full hotline support before deploying ELM, the group decided to focus instead on training materials that would reduce the need for hotline support.

The ELM working group also included a contingent that did not want to settle for a terminal-to-host e-mail system such as ELM, preferring to wait—even if it meant waiting two or three years—for Penn's infrastructure to support client-server e-mail. We worked hard to convince these people of the value of ELM as an interim solution.

Put up something "good enough to build interest." Our strategy was to deploy a reasonably user-friendly interim system like ELM in order to build interest in e-mail itself. We hoped that a more e-mail-literate community would push for the infrastructure investments that would make client-server e-mail possible in the future.

Make it clear decisions will be made. We made a point of discussing an issue for several meetings and then announcing, for example, "At the next meeting we will make a final decision on which editor to use. Please bring the right people to make that decision." It seemed to work. The right people came to the meetings, decisions were made fairly smoothly, and people did not come back later saying they were not consulted.

Use "They're going to do it anyway" productively. Several times when consensus seemed to break down we reminded the group that Arts and Sciences was going to deploy ELM for its 10,000 students no matter what the group decided to do. Arts and Sciences therefore served an energizing, forcing function to make the community act and keep it united throughout the project.

We're all in the lobbying business. Three of the large schools banded together to pressure the fourth—Arts and Sciences—to select an e-mail solution that would work for everyone. The small schools used the task force to pressure their deans to devote more resources to computing. The large schools used the group to pressure central computing to provide support. And the schools were not the only ones to pressure central computing. The chair of the task force, a member of central computing, used the group to pressure his own organization, whose management does not always agree where to devote energy and resources.

Train more than one facilitator. Several members of the ELM group had recently attended a facilitator training course together. When meetings seemed to go astray, they would look at each other and try out techniques they had learned.

A post-mortem is worth the effort. Doing a CAUSE paper forced us to evaluate what went right and what went wrong—well worth the effort. We also assigned ourselves the task of analyzing three important current efforts to see if we really had learned lessons from the e-mail task force.

Wrap-up

Almost twice as many Penn faculty and students will soon have e-mail. We didn't agree on *one* e-mail system, but we agreed on a manageable, supportable few. We found a middle ground between expedient and state-of-the-art solutions. Most importantly, we built partnerships, tested strategies for division of labor across the University, opened channels of communication, and laid the groundwork for political coalitions. We think we've been faithful to Ben Franklin's dual messages of independence and collaboration, honoring the schools' need for flexibility and independence while finding a way to work together for the good of the whole.

Managing Videoconferencing is Building Ubiquity, Cutting Costs, and Communicating Easily: Not Just Talking Heads

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ABSTRACT

This paper will describe experiences of Arizona State University in implementing a tri-university digital videoconferencing system. Videoconferencing is an electronic meeting in which geographically separate groups communicate using live interactive audio, video, and computer technology. Many universities are turning to videoconferencing as travel costs increase and when administrators' time is being stretched tighter than ever. Universities are being asked to do more with less. The solution is videoconferencing for university business meetings and for the delivery of distance education. Technological improvements, lower prices, easy of use, and increased availability are making videoconferencing an option and a necessity for universities.

What is Videoconferencing?

The term videoconferencing used very loosely, means a geographically separate electronic meeting using both interactive audio and video. For the purposes of this paper, the term videoconferencing is referring to a simultaneous two-way interactive meeting with motion video. All of the different types of videoconferencing examined in this paper are using compressed digital video. Videoconferencing technology extends the communication reach of people to have simulated face-to-face meetings--where the only thing missing is the handshake! Videoconferencing allows people at different locations to communicate in a face-to-face manner more often; and more effectively than any audio form.

What videoconferencing is really about is cutting costs, building ubiquity and communicating easily.[1] Information technology professional's principal role, once again, is to help cut costs in administrative and academic procedures. Not, since the data processing era of metrical measures like "head-count reduction," have information technologists been seriously pressured to help: trim the budgets, create more productivity, and add value to the university missions. One method to alleviate this pressure is the proper utilization of videoconferencing. Videoconferencing helps to cut travel budgets, travel time to meetings, and avoids expensive scheduling conflicts. When geographical location is mitigated various cost savings and productivity developments occur. Building ubiquity with videoconferencing is making the technology as readily apparent as the telephone. Ubiquitous videoconferencing means a videoconference can be made anytime and anywhere. As information technologist's, our role over the last decade has been to provide ease of use in whatever management tool we introduce. Ease of use is being achieved, so almost anyone can learn to place a videoconference call, no matter what type of equipment. This seven year old industry is providing all participants the same "driving experience." The use of videoconferencing equipment is analogous to a driver knowing just where the steering wheel is, the gas, and the brake. Communicating easily is what videoconferencing is all about! The technological advances are occurring at such a rapid rate, the day of using videoconferencing like George Jetson, in his cartoon *The Jestson's,* is almost here.

Why Videoconferencing?

Since the prehistoric period, human beings have always exhibited the need to be visual. From cave drawings, to today's age of multimedia, man has always had the desire to communicate more effectively. The importance of visual communication is emphasized in mans' rush to use videoconferencing and other moving graphical-based images. This imaging movement is known as the second computer revolution--multimedia. Images are the most effective communication medium; and almost everyone agrees with the old adage, "A Picture is worth a thousand words."[2] It is not surprising to discover the largest proportion of the brain is solely devoted to the visual sense. Enough can not be said, about the importance of nonverbal communication or visual cues. According to Walsh, in face-to-face communication: seven percent of the message is received by word meaning; thirty eight percent is attributed to how it is said; and fifty five percent of the communication message is in the form of visual cues.[3]

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[1] Ron Taylor, "Videoconferencing --Building Ubiquity, Cutting Costs, and Communicating Easily," Telecommunications, August 1991, p.46.

[2] John Walsh, "Personal Video: A Reality," in ITCA Teleconferencing Yearbook 1992 (Washington, D.C.: International Teleconferencing Association), 8.

[3] Ibid.,p.8.

Forces in Action

There are three forces causing videoconferencing to come of age. These forces are: 1.) Technological; 2.) Economical; and 3.) Organizational. Technologically, videoconferencing has become a practical business tool due to better picture and sound quality delivered at lower bandwidths. What has helped to age this industry is bandwidth being virtually reliable and available on-demand. Other factors, like the international standards that are now in place, ease of use, and smaller equipment size has lead the market toward maturity. "Developments in video and audio compression technology and the availability of low-cost ISDN circuits, have led to a rapid growth in the market for dial-up videoconferencing."[4] All of these technological market changes have added to the growth of videoconferencing, but the introduction of increasingly more powerful and flexible products has converted this technology into management's newest and most powerful productivity tool. The technological push that is occurring is important, but all of the present "techie" hype about videoconferencing has occurred before. Over three decades ago, the technology never materialized into anything for practical use. So, what other forces are in action making the videoconferencing industry grow?

Economical forces have always had a tradition of being the strongest forces to influence behavior. The real economic metamorphosis is the transmission charge and bandwidth necessary to have a videoconference drop to the cost of a simple phone call. What also helps is decreasing equipment costs to $2,000 for desktop videoconferencing and $20,000 for group videoconferencing. The reduction of these two monetary barriers has opened up videoconferencing for the smaller colleges and financially strapped universities. These cost reductions diminish some of the reluctance for colleges and universities to try videoconferencing, but other economic forces are at work to bring videoconferencing to a campus near you!

Videoconferencing's major appeal is still travel reduction. Many consultants and information technology professionals have proven videoconferencing's case built solely on cost/benefit analyses in travel reduction. Sandy Kyrish states this reasoning is sound, "But treats videoconferencing as an application, not a communications tool."[5] Many communication researchers have found travel is not reduced due to videoconferencing, but just displaced. The real economic payoff is the reduction in the time it takes to get to the meeting and to make a decision.

Distance education courses delivered via videoconferencing have proven to be quite profitable and perfectly acceptable at many colleges and universities. Videoconferencing, economically is a true viable option for educators to meet a huge untapped market, that is willing pay for education, but insists on it being delivered to a location of their chose. Location and the ability to communicate interactively is important. A host of economic forces are bringing videoconferencing into our schools, offices, and soon homes; however, another strong force is working to bring this technology onto campuses.

Organizational forces are at work to see that videoconferencing becomes a practical and prominent business tool. Many university and college systems are geographically decentralized and centrally controlled. In an effort to manage these far-flung entities, videoconferencing is used to coordinate and thwart the demands of intra-university travel. For these organizational reasons, many state university and college systems are beginning to employ videoconferencing.

University's organizationally are changing to meet the needs of the educational environment of the next century and this process is causing a paradigm shift to occur. Whether colleges and universities call their efforts total quality management, quality improvement, or strategic quality management, these overall efforts focus to form cross functional work teams. All of the quality efforts focus specifically on better communications and outreach to customers externally and internally. Videoconferencing can be used to help increase productivity through better and more communication. This technology has been invaluable for strategy sessions, training, and fiscal budget reviews, where cross functional teams are geographically distributed. Whether campus forces are driven by technical wizardry, spurred by tightening budgets and travel costs, or confronted with organizational issues, videoconferencing has proven to meet the communication need.

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[4] Tim Duffy, "Videoconferencing: A Market in the Making?" Telecommunications, April 1992, p.41.

[5] Sandy Kyrish, "Value-Added Approach Boosts Videoconferencing Growths," in ITCA Teleconferencing Yearbook 1992 (Washington, D.C.: International Teleconferencing Association), p.57.

System Basics

Tailored or packaged videoconferencing equipment makes the technology appropriate for a variety of university and college needs. Despite some of the bells and whistles on some videoconferencing systems, they all contain variations of the same system basics.

Video Codec

At the heart of the videoconferencing equipment is the video codec. This device translates analog video signals into digital output. Most video codecs can compress the amount of digital information that is transmitted. In this compression process, a mathematical algorithm is used. According to Thurston, "There are four steps to video codec technology:

- *preprocessing*-removes high-frequency noise,
- *encoding*--each block of the picture ranging from 8 x 8 to 16 x 16 pixels in size is digitized,
- *decoding*--the digital signal is turned back into a picture,
- *post processing*--noise is removed."[6]

For information technologists, the best way to understand video codecs is to think of them as the video counterparts to modems. There are three distinct and different coding techniques. For major scene changes, *intraframe* coding technique is used, which removes redundant data from within the frame. *Interframe* coding technique compares a frame with the previous frame and transmits only the changed parts. *Predictive* coding technique transmits only the changed portion of the motion, which varies from the prediction made in the algorithm. The majority of the good codecs use various combinations of these techniques.[7] Codec selection is still based on price/performance options. Selection is not as risky, due to the Consultative Committee of International Telephone and Telegraph (CCITT) ratifying, an international standard (H.261). This standard is pervasive, which means most systems are compliant with the standard and can communicate with each other. Codec performance can be evaluated in three ways: resolution (the amount of video converted to produce a clear picture), motion handling capability (the operation data rate when the picture is blurred or breaking up), and frame rate (how many frames refresh in a second that causes the flicker or jerky picture quality).[8] The codec can be thought of as the engine that drives this technology.

The CCITT has decided on an entire suite of standards, but the most talked about standard, which most technologists believe to be the real breakthrough is H.261. The standard is also referred to as Px64, and it allows different codecs made by different manufactor's to speak the same protocol language .[9] The standards for videoconferencing are good, but there still is much work to be done.

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[6] Francine Thuston, "Video Teleconferencing: The State of the Art," Telecommunications, January 1992, p.64.

[7] Ibid., p.64.

[8] Edward A. Daly, We've got to start meeting like this (Atlanta: KJH Communications, 1991) p.57.

Transmission Medium

The transmission medium can either be a dedicated type, like a private T1 circuit, a carrier service, like US Sprint's Meeting Channel, or switched services, like AT & T's Accunet Switched 384kbit/s and 56kbit/s Service.[10] Digital signals can be sent via satellite, terrestrial circuits, microwave, and dial up telephone service. The general rule for videoconferencing transmission is the higher the transmission rate, the sharper the picture quality. Most videoconferencing vendors are working on improving the quality of the system at lower transmission rates, to take advantage of lower tariff charges. Richardson calls the technological focus on lower bandwidth delivery and higher quality pictures as "bandwidth end-runs."[11] The preferred operating transmission rate is 384 kbit/s, but many universities and colleges are using dial-up on demand switched 56kbit/s service. Better quality will continue to be achieved at lower bandwidths.

Cameras and Monitors

If beauty is truly in the eye of the beholder, then video quality is biased by ones perceptions, and this leaves the measurements and predictors very subjective. Perceived picture quality is affected by many factors: spacial resolution, color retention, contrast, and image smoothness. The normal participants in videoconferencing sessions do not notice picture sharpness, unless the frame rate is lowered to less than 20 frames per second.

Cameras and monitors come in many shapes and sizes. There are single fixed camera and monitor systems, dual camera/dual monitor systems, and multiple camera systems. In the selection of cameras and monitors, the number of active participants is paramount to the selection of the equipment. Most group videoconferencing equipment cameras can capture 3 to 4 participants, with some detail. The normal monitor size is 27 inches. In order to get more participants into the videoconference, camera switching is used. Camera switching is when there are remote control cameras, which commonly have the ability to pan, tilt and zoom in. Another way to achieve the frame of more individuals, is continuous presence presentation or split-screening. This is breaking up parts of the picture, by using the top and bottom portions of the screen to show the other participants (stacking). The stacked signal is sent to the receiving videoconference participants, so they can see more participants on a split-screen.[12] A helpful feature most videoconferencing systems contain is windowing. With this feature, a window displays to the sending participants a reflection of how they appear at the receiving end. Just as there can be one or more monitors, the number of cameras chosen depends on what is to be displayed. Optional cameras are called "wild cameras" and they include graphic, document, motion, slide-chain, and overflow cameras, which can be used to handle other forms of visual communications.

Control System

The control system consists of a hand-held or table-top device that integrates the cameras, monitors, graphics, audio and sometimes the dialing function. Many vendors of videoconferencing systems have different control systems, but most allow the participant to select cameras and settings like zoom or pan, control the audio volume, change the windowing, display and preview graphics, and remotely operate the auxiliary equipment. The ease of use of the videoconferencing system is directly related to the simplicity and responsiveness of the control system. Some videoconferencing participants find it difficult to operate the control system, while involved in the videoconference. These users are accommodated with a system that is handled by an "operator," whom usually is not a participant in the meeting, but runs the control panel.[13] It is wise to look for ease of use and a smooth driving experience when purchasing a system.

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[9] Larry Ehlers, "Primer on Interactive Videoconferencing." in ITCA Teleconferencing Yearbook 1992,(Washington, D.C.: International Teleconferencing Association), p.52.

[10] Francine Thuston, "Video Teleconferencing: The State of the Art," Telecommunications, January 1992, p.63.

[11] Steve Richardson, "Videoconferencing: The Bigger (and Better) Picture," Data Communications, June 1992, p.106.

[12] Edward A. Daly, We've got to start meeting like this (Atlanta: KJH Communications, 1991) p.57

Audio System

The most important component in videoconferencing is the audio system. People generally are forgiving of poor picture quality, but if they can not hear properly, or they are disrupted while speaking, they are thoroughly dissatisfied with the system. Audio can not be "here and there", rather consistent and of high quality. The biggest problem with the audio system is controlling echo. Echo is when the sound that is received, is heard by the microphone at the receiving site, and it is sent back to the participants, where it originated. There are two methods to deal with the problem of echo. Echo cancellation is one method of removing echo feedback from the videoconference. Echo cancellation holds the incoming signal and compares it to the outgoing signal, when it finds a duplicate it cancels it. The echo cancellation device can remember the specific acoustics of each conference room, and store this information, so the rest of the conference can be held with the elimination of the echo.[14] When the conference participants are very informal and interactive, they may want to use this canceller device.

Echo suppression is sometimes called gating. Echo suppression is achieved by letting the audio transmit only one way. Another method is reducing the speaker level of the incoming audio when a participant is talking, and by suppressing the outgoing audio when someone at the other site is talking. Think of echo suppression as muffling the speaker at the other site. An advantage of this is the inability of speakers to interrupt each other. A disadvantage of echo suppression is "clipping" occurs, this is where the beginning of words are not heard at the other site.[15] If meetings are very interactive a university or college may want to use echo cancellation, because it is interruptable. On the other hand, if most videoconferencing sessions are one participant speaking for a longer duration, then echo suppression is preferred, because the speaker is not easily disturbed.

Audio is transmitted out-of-band (audio traveling separately) or in-band (the audio portion is sent with the video signal). The audio is referred to as either full-duplex, half-duplex, or switched. Today, most of the videoconferencing systems allow more audio frequency to be delivered than a normal telephone call, and less than television or radio programs. It is best to get an audio subsystem that is capable of more than 7kHz audio.[16] The placement and quality of the microphones is a large determinant of the quality of the audio. Generally, tabletop microphones are used, which are omni-directional (they pick up sound within range of any part of the room), or directional (picking up sound from a specific location). Hand held and lavaliere microphones can be held or worn by the participants. Other microphones may be placed about the room to pick up the side conversations. Speakers are usually built into the modular cabinet type systems, and broadcast speakers can be used in the rear of the room, or in an overflow room, if more participants attend. The audio system is the most important element of the system, but sometimes the least thought of.

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[13] Tim McElgunn, "An Overview of Videoconferencing Systems," (Datapro Management of Telecommunications) October 1991, 105, Datapro MT60-630-102.

[14] Edward A. Daly, We've got to start meeting like this (Atlanta: KJH Communications, 1991) p.32.

[15] Tim McElgunn, "An Overview of Videoconferencing Systems," (Datapro Management of Telecommunications) October 1991, 105, Datapro MT60-630-101.

[16] Edward A. Daly, We've got to start meeting like this (Atlanta: KJH Communications, 1991) p.32.

Room Conditions

To achieve good quality audio, room acoustics are needed. Most universities and colleges do not have the luxury of having an extra conference room to convert to a broadcast studio, but many options are available, which are inexpensive and very effective, to make due with what is obtainable. Room treatment and conditions can be most accommodating to videoconferencing by just changing the lighting, arranging the conference table, adhering to a proper ambient noise level, and working with the size of the room. Lighting needs to be non glaring, only one kind, and even throughout the room. The conference table should be large enough to give participants 2 to 3 feet each. A round or V-shaped table can provide better views for the videoconference. Commonly the room should be free from a noisy hall, and Daly mentions, "an ambient noise level of at most 45 decibels is required."[17] Unfortunately, most university and colleges can not achieve this, so wall treatments and sound absorbing tiles can be used. An "in use" sign can be used to keep outside noise down. Blue and gray seem to be the best colors for a site. Many minor inexpensive changes can be made, to leverage the investment in videoconferencing equipment, with room condition enhancements or arrangements.

Options

Many options can be chosen to add-value to the videoconference. Some of these are computer interfaces, extra phone lines, still video systems, electronic response systems, VCRs, electronic annotation devices, image capturing tools, electronic pens, and security encryption devices. Many of these add-on options help ensure effective communication and a successful videoconference. The best advice for designing a videoconferencing system is to visit as many different videoconferencing sites as possible.

Multipoint Videoconferencing

Videoconferencing among more than two locations is a whole different ball game. Multipoint videoconferencing permits three or more locations to participate. Many problems occur when every location can send and receive audio/video at the same time. To alleviate these problems, technical protocols are put in place to see and be seen, and hear all participants. The protocols or methods to produce multipoint videoconferencing are voice-activated switching, chairman control, self-selection, and windows.[18] In order to perform voice-activated videoconferencing a multipoint control unit is used. This device is a sort of an electronic middleman, which automatically switches the correct audio/video to all locations in the videoconference. The multipoint control device can be connected together or cascaded, to allow for many locations. This method allows each site to see the site that is currently speaking, and the speaking site, sees the site of the previous speaker. Advantages for this method are it is unobtrusive and automatic. The disadvantage is a cough or loud noise can disrupt the videoconference. Another method is chairperson control, where a chairperson is chosen, and the audio/video from the chairperson's site is sent to all others, and the chairperson views audio/video from the previous site. The chairperson's role can be passed to the other sites. The disadvantage to this method is the loss of spontaneous interaction, but the advantage is there are no random glitches like clipping. The self-selection method is like answering questions in a game show. The site that wishes to be seen and heard presses a button to do so. Windowing is simply placing all the sites visually in the monitor and giving the participant the ability to select who he/she wishes to see (Hollywood Squares). This multipoint method is not very popular, but it may be the approach to perform multiple desktop videoconferencing. The standards are not as finalized for multipoint videoconferencing, as point-to-point. Multipoint videoconferencing is less like face-to-face meetings, still many university and college systems are using multipoint videoconferencing for senior level meetings to avoid travel time between the distant system schools.

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[17] Edward A. Daly, We've got to start meeting like this (Atlanta: KJH Communications, 1991), p.44.

[18] Edward A. Daly, We've got to start meeting like this (Atlanta: KJH Communications, 1991) p.69.

Desktop Videoconferencing

The hottest talked about technology is multimedia and one of its greatest applications is desktop videoconferencing. By moving videoconferencing to the desktop many campus information technology organizations will be able to take advantage of this still primitive technology. When a study found that video increased retention by fifty percent--imagine the increased effectiveness in communication with desktop videoconferencing.[19] Although customer acceptance with the AT & T picturephone is presently unclear, desktop videoconferencing seems to be accepted in the campus environment. The first-to-the market products are based on Compressed Digital Video (CDV) technology. The basic components of a desktop videoconferencing system is a codec circuit board, video processor board, camera, microphone, digital phone line or analog telephone, some communications software, and of course a microcomputer. The cost is right around the $2,000 range, and market sales have been characterized by millions of units, due to market projections stating it will increase eighty one percent by 1995.[20] Desktop videoconferencing at its' best, has been performing at approximately 15 frames per second, and a 128H by 112v resolution. The transmission mediums are ISDN, FDDI, ATM, LANs, ethernet, cable and plain old telephone service (POTS). Similar to email's emergence as a key tool on campuses, desktop videoconferencing will build on email's success, and help campus faculty, staff, and students to meet in groups geographically distributed around the campus network. The college and university network infrastructure is best suited to allow its' community on campus to be pioneer's in desktop videoconferencing.

Arizona State University 's Videoconferencing History

Shortly after the Arizona State University (ASU) West campus was formed (the first branch campus), the president of Arizona State University in 1990, asked for teleconferencing proposals for communications between the main and west campuses. He insisted that ASU proceed with a pilot project in the teleconferencing area. The reason for the president's memorandum to look into the option of teleconferencing between the two sites was economical and organizational. The president's cabinet was not worried so much about the direct cost in traveling 20 miles to the West campus. They were frustrated with the time spent traveling and the scheduling problems endured to meet with staff at both locations. The organizational change (a new campus) made it imperative for the president to meet with the new administrators of the ASU-West campus regularly. The memorandum also asked for key principals in teleconferencing to identify a pilot, a long range form, and what the costs for both would be.

Alternatives evaluated for teleconferencing between the two campuses were: using microwave dishes; piggy backing on the instructional television fixed service; and a modular compressed digital videoconferencing system. After much debate, the decision was to purchase the compressed digital videoconferencing unit for communication between the ASU-Tempe and ASU-West campus. The decision, according to a presidents cabinet member, was based on the systems cost effectiveness, time to install, and privacy to the videoconferencing participants.

Shortly after the decision to use compressed digital videoconferencing between ASU -Tempe and ASU West, the Council of Presidents (COP) proposed to look at videoconferencing for their tri-university meetings to avoid loss of time due to travel. The COP, consists of the presidents from

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[19] Tony Reveaux, "Videoconferencing Moves to the Desktop," Newmedia, November 1992, p.33.

[20] Jeanette Borzo, "Multimedia Uses Expected to Grow," Infoworld, 10 February 1992, p.19.

Arizona State University, Northern Arizona University, and the University of Arizona, and they appointed a tri-university task force to make recommendations. For videoconferencing between the three universities, two forms of technology were proposed: compressed video and analog video based system. The task force was split between the two systems; however, the COP, due to time and cost factors, chose the compressed digital system to be developed first. The criteria for comparison of the two systems was: motion quality; privacy/security; convenience/access; expandability; cost; and revenue potential. The multipoint compressed digital system is operational and is generally viewed as a success. An overview of the system is provided (See Figure 1, p.11). Presently, work is underway to also develop the analog video based system.

Specifically, what ASU wanted for the tri-university system was minimal on-going operational costs, the least cost up front, minimal set up time, the system to be self operated, and to be private and secure. The COP purchased a modular PictureTel 4000 videoconferencing system with a PictureTel M-8000 Bridge. This system allowed the three universities to use voice activated switching and view video at 10 frames per second. The system is upgradable and easy to set up. By deciding on compressed digital, minimal conference room arrangements were needed. The system implementation has been a critical endeavor and the experience was, and still is, a great teacher.

Lessons Learned and Pitfalls to Avoid

This report can not speak for the other universities, but many valuable lessons were learned at ASU about point-to-point and multipoint videoconferencing. Because the primary participants for videoconferencing were senior officials, the privacy and security issue held a lot of weight when viewing alternatives. Another lesson ASU learned, was lighting and sound controls need special attention during "burn in" of the system. Regardless of how many people the videoconferencing system was designed for, the conference size continues to grow. ASU has had over 30 people to observe a videoconference, and some people had to go to an overflow room to listen with a speaker phone. Depending on the number of people participating in the videoconference, the spacial organization of the people must be addressed properly. One lesson learned, the hard way, was scheduling the videoconferences. A schedule system must be developed and kept between the three schools. Setting up a reference checklist is also a key to ensure the videoconference runs smoothly. An additional lesson is to have helpful documentation about the operation of the equipment, and thoroughly train and retrain, the participants and support staff. Some leadership is needed from the participants, which have experience in videoconferencing, to help the other participants understand the procedures and helpful hints, like handling the pause during switching. The most important lesson learned by the information technology organization is to always have a technical person standing by.

A primary pitfall, or problem, is the audio portion of the videoconference not being heard properly. This occurs when a participant is not close enough to a microphone or does not enunciate clearly. Most often, the videoconferencing participants want to pick up side conversations in the meetings, but this seemed impossible to do with the present system. What was discovered, is in order to pick up more background sounds, the telecommunication department bought inexpensive Radio Shack microphones and hung them on the wall to rectify the situation and it alleviated an echo problem at the same time. An unique pitfall occurs if camera angles at all sites are not properly set . For example, one tri-university site has the camera mounted very high, and every other location feels they are always looking down at the top of their heads. Another pitfall to avoid, is educating the participants to correctly use the document cameras and to help participants prepare to use the graphics cameras or fax materials ahead of time. Everyone will want to use the equipment once it is in place, so policies need to be made stating the use, and prioritization of groups. While *The Chronicle of Higher Education* touts in headlines, "Colleges use video conferences to trim their travel budgets," evaluation is needed to not only justify the cost saved in travel budgets, but to measure the productivity and time gained by the employee, who does not have to drive to Tempe for two hours to get to the meeting.[21] Other evaluation measures about the system operation are sorely needed. One of the largest pitfalls of ASU's experience in videoconferencing, is that no classes are delivered through the system; however, a new site is waiting to be opened to do just that.

ASU's Future for Videoconferencing is Bright

Most of the experiences ASU and the other tri-universities have had with videoconferencing applications are frequent board meetings, emergencies requiring group participation, or important time critical messages that have to be delivered. Many other applications are possible, but the application more presidents are mentioning is videoconferencing for distance education. Due to tight fiscal times, this instructional delivery vehicle (digital video) is viable and profitable. The quality of compressed digital video is closer to business television (ITFS), at one-fifth the cost to broadcast. For example, several schools like the University of Missouri have been using compressed video technology to deliver upper-level, undergraduate courses and graduate courses, primarily to non-traditional students, for quite a few years now.[22] Other state university systems, such as the California State System and the University of Minnesota System have been satisfied with assessments of videoconferencing for teaching in the virtual classroom. Many believe one of the greatest technology payoffs in higher education will be videoconferencing for distance education.

The new Computing Commons building on ASU's campus has a conference facility specifically built to produce ideal videoconferences for simulated face-to-face business meetings, and to develop ASU's virtual classroom for distance education. The proposed Arizona State Public Information Network plans for 15 fully equipment videoconferencing sites. ASU's videoconferencing link to our Community College system is present and postured to deliver distance education. With the microwave links coming to the tri-university networking infrastructure and the tri-university experience as a guide, Arizona's videoconferencing picture is bright.

Videoconferencing Benefits and Limitations

In these times of increasing and rapid change in higher education, videoconferencing is not a panacea, but a boon to good management decisions, distance education, and increased productivity. The videoconferencing benefits are both tangible and intangible. Reducing travel expense and time is constantly eluded to, but the primary benefits are faster decision making, more informed or better decisions, and the ability to get more people in on the mission critical decisions, which university management makes. The payoffs are value-added and budgetary.[23] The cost versus utility threshold for videoconferencing is presently being met, and price barriers to implement this technology at all universities and colleges is being removed. There are many positive spill-overs and linkages to using videoconferencing for example; the ability for spontaneous meetings, increased participation, better coordination and control, and additionally, there is no need for traveling dog and pony shows by university personnel.

The predominant limitations for videoconferencing were cost and availability, but public videoconferencing systems are considerably lower in cost and generally available on demand.

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[21] Katherine Mangan, "Colleges Use Video Conferences to Trim Their Travel Budgets," The Chronicle of Higher Education, December 11, 1991.

[22] Coleman H. Burton, Digital Video, (Lexington, KY: The Association of College & University Telecommunications Administrators, 1991), 2..

[23] Sandy Kyrish, "Value-Added Approach Boosts Videoconferencing Growths," in ITCA Teleconferencing Yearbook 1992 (Washington, D.C.: International Teleconferencing Association),p.57.

There are still some technical limitations and standards to be decided on for videoconferencing. Acceptance of the practice is also a limitation, but many faculty, staff and students would rather avoid the travel and use videoconferencing. Despite the limitations, the climate for this new technology is right.

The technical aspects of videoconferencing, while somewhat challenging, pale in comparison to other aspects that must be addressed to successfully introduce this new technology. The single most essential element of videoconferencing is management. Proper management and planning for videoconferencing is paramount due to the senior management audience typically served by videoconferencing on campus. Management of videoconferencing must be an on-going and continuous effort. One of the fastest way to be without a job in information technology is to have a videoconferencing system continue to fail with the presidents and senior state officials as participants.

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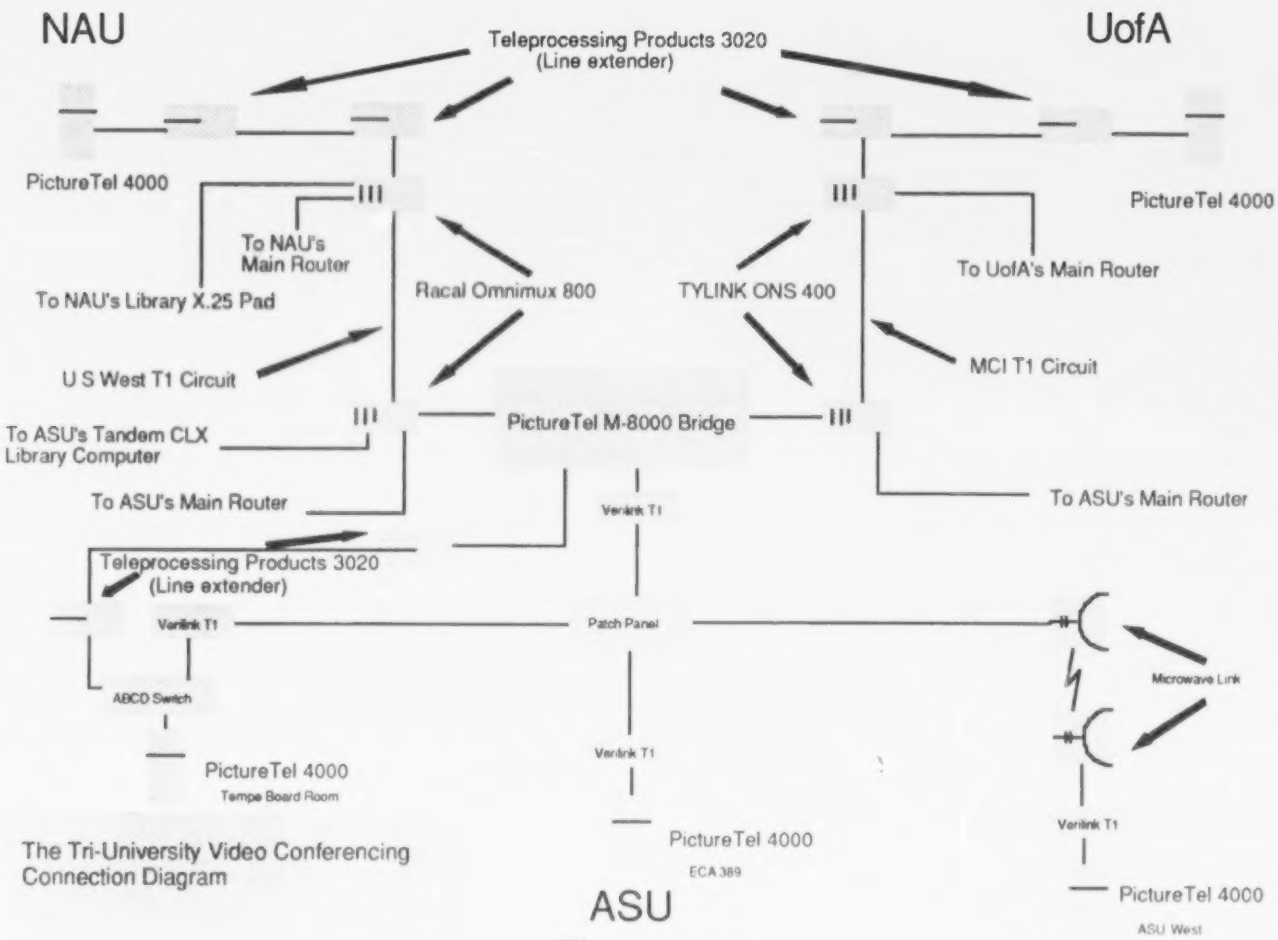
Tri-University Videoconferencing System


NAU
Teleprocessing Products 3020
(Line extender)
UofA
PictureTel 4000
PictureTel 4000
To NAU's
Main Router
To UofA's Main Router
To NAU's Library X.25 Pad
Racal Omnimux 800
TYLINK ONS 400
U S West T1 Circuit
MCI T1 Circuit
To ASU's Tandem CLX
Library Computer
PictureTel M-8000 Bridge
To ASU's Main Router
To ASU's Main Router
Verilink T1
Teleprocessing Products 3020
(Line extender)
Verilink T1
Patch Panel
Microwave Link
ABCD Switch
PictureTel 4000
Tempe Board Room
Verilink T1
Verilink T1
PictureTel 4000
ECA 389
PictureTel 4000
ASU West
ASU

The Tri-University Video Conferencing
Connection Diagram

Figure 1

Managing the Network

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ABSTRACT

Once you have strung the wires and created a network, or multiple networks, you soon find that there are many other tasks that need to be performed. Compounding this problem is the various perceptions that different groups of individuals have of the network. From the user's point of view they want an easy to use, reliable, inexpensive way to utilize the network. The people who wire the network are concerned about keeping track of where all the wire goes and fixing breaks. The people who design the network are concerned about gateways, protocols allowed over the network, and traffic throughput. All of these individuals may not be interacting with each other for the good of the total network performance.

These problems grow bigger and bigger as the network grows and departments want to connect their computers to gain access to the campus network and all of its capabilities. This paper will concentrate on managing the look of the network to the end user. Another paper, "Building an Effective Organization to Run a Campus Backbone Network", presented by Claudia Jordan at this conference, will concentrate on the organizational aspects of managing a network.

What should a network do?

In my opinion the most important thing for a network to do is to be invisible to the end user. This may seem a bit one sided and crass, since a massive effort has gone into the design, installation, and monitoring of networks. However, if you stand back and look at the purpose of the network, it is to facilitate the flow of information. It needs to leverage the knowledge of the end users of the information. It is to that end that we must always keep in mind as we design and implement our networks. Just as the telephone company does not emphasize its digital transmission and switching capability, we should not be trying to discuss TCP/IP when talking about our networks.

We should be trying to "manage" the network as an information providing tool. The underlying wires and protocols are the foundations needed to provide the means of this information providing tool, but they are not the end product.

We have traditionally concentrated our efforts toward the technology of the network, viewing it as a physical entity, rather than how it is utilized by researchers and secretaries. We have created this thing called the network, we now need to nurture its growth in the open environment in which it has flourished.

How do you "manage" something as diverse as a network?

Perhaps the word manage is a poor choice. As Grace Hooper so aptly said "You manage things, you lead people". As professionals in this industry we need to keep abreast of the technology and provide the leadership to steer us into the future. That is a wimpy politician type statement that does not get down to just what it is that we need to do. So, as Ross Perot has said so many times recently, lets get right down to the issue.

Establish an organization that is set up to act on the directions needed to implement your institution's goals. Use existing programs to make the network as easy to use as possible. To make a network system work effectively, you need several basic things.

- It has to work reliably.
- It has to connect you to the resources you need or want.
- It has to be usable by mere mortals.

- It has to have consulting support.
- It has to be fast, and able to grow as usage increases.
- It has to be reasonable in cost and supported from the top.

In order to have a working network, it needs to be viewed as a system of interlocking parts; that, when viewed as a whole, has a nice "look" and "feel". The network system has to have all of the technological components to make it work, but it also needs the end user to be able to use it effectively.

Central computing centers are no longer the center of computing, as they were 10 years ago. Distributed computing is no longer something we talk about as a possibility, it is a fact. How we react to the next phase, that of providing leadership in the integration of the network to the needed data, has a strong relationship to our ability to exist in to the year 2000.

Providing a network support system.

A network has many separate components that have traditionally been separated organizationally. You may well argue that a person out in the trenches, training end users, does not need to know where and how the campus backbone routers are organized. If you get a call from and user setting up a LAN on the same side of a router, you soon find out differently.

The network organization has to be set up so the knowledge of the network design experts is disseminated to those who need to know. We need to use the very network we designed to get this information to remote individuals who can not attend all of the informational meetings providing this information.

We are in a distributed environment, with limited time and budgets. We need to utilize every technique we have available to us to distribute information to end users and network administrators out in the departments hooking up LAN's.

One component of the network organizational structure is the function of a Network Information Center. This may not be a separate department, but it must be a part of the network function. This is the area I am most familiar with, so I would like to highlight some if its functions in the next section.

The Network Information Center (NIC)

On a national network level, the Network Information Center is normally involved in providing information on how to connect the campus networks to larger regional or national networks. It is usually not involved in providing end user information.

On a campus, or local level, the need for end user support is very much needed. Because this function is so important, a NIC was set up at Ohio State University shortly after the campus network was installed.

We dedicated a full time person to assist in documentation and developing training materials. In a two year period over 63 documents were created to meet end user needs.

On a local basis, you may have several mainframes, and a multitude of microcomputers, running various communication links connecting everything. Providing all the documentation for each of these links is not a trivial task. The tact we have taken at OSU is to break documents into small sections, each addressing one specific task. For beginners, there is a "Getting Started with the Network" that describes what network is, and how in can be used. At the next level, we have the "How to connect" type document describing connecting to local and remote computers as well as file transfer techniques for each computer configuration.
These documents are available in printed format and available 24 hours a day. The most popular are broken up by major topic and provided on-line via a Gopher interface.

Even with all of the documentation in the world, you still have to provide training. In most cases, we provide training on networking in the same fashion that the documents are organized. For beginner, there is the "What can Networking do for you" type of workshop. There are e-mail workshops for those primarily interested in sending e-mail, using the various e-mail systems available. Finally, there is the "How can I effectively use the resources available on the network" type of workshop, for those who need to go beyond the basics.

There is the consultation function for those specific questions that have to be answered "right now." For instance, are you prepared to answer these questions?

- What is the difference between the Internet and BITNET?

- How to I get the e-mail address of Joe Blow in England?

- How do I get my Wordperfect document sent via e-mail?
- How can I get access to the computer that allows me to display the pseudo stress vectors of the South Pacific for March of 1989?

These type of questions require a different level of knowledge than many of our traditional consultants are trained to provide. We need to be anticipating these needs and developing the tools to provide this type of information easily.

Using existing resources.

There are many resources that you can use to arm yourself to meet these challenges. They are available on the network and mentioned in several recently published books.

Gopher - A program running on many types of computers that allow very easy navigation of the network. This is a must have. If you are not running a server for your facility you should be thinking about it seriously.

Archie - A program that can search for files available via anonymous on the network.

WAIS - A program that can search specialized data bases provided on the network.

Pop Mail - A program to allow reading mail using the native PC's interface, such as the Macintosh's point and click techniques.

Some recent books of interest.

Zen and the Art of the Internet - a Beginner's Guide by Brandan P. Kehoe, PTR Prentice Hall, ISBN 0-13-010778-6.

BITNET for VMS Users by Michael A. Moore and Ronald M. Sawey, Digital Press, ISBN 1-55558-094-7.

Crossing the Internet Threshold an Instructional handbook by Roy Tennant, John Ober, and Anne G. Lipow, Library Solutions Press, ISBN 1-882208-01-3.

CICNet Resource Guide, edited by J. Paul Holbrook and Christine S. Pruess, available from CICNet, Inc. 2901 Hubbard Dr., Ann Arbor, MI 48109-2016 for $27.

The Whole Internet User's Guide and Catalog by Ed Krol, O'Reilly and Associates, Inc.

Problem tracking.

As the network grows so does your user base. Problems can enter your organization at many points. Even if you have a central point for reporting problems, they will not always reach that location.

A problem tracking system can provide the needed information on what is going wrong in your network. Armed with this information, you can make better decisions on what action needs to be taken to fix it. It can also point out reoccurring problems. Finally, it can act as a central location for information. If your modem pool is down, anyone in your organization can call the central location to discover what the problem is, and when it can be resolved.

Putting it all together.

I would suggest we should not try to manage our network, but rather to lead those involved with the network on a trail to the future. To do that, you need to develop a computing plan for a short period of time, from 3 to five years. You should include:

- A comparison of your institution with institutions of similar size on key measures, such as computers connected to networks, or computers outdated and needing replaced.
- Specify goals of your network.
- Specify what requirements you feel need to be meet to goals.
- Specify the possible consequences of meeting or not meeting your goals.
- Show how you would implement each goal, and the relative importance of each goal to the well being of your institution.

This plan needs to be developed with top management, so they will at least be aware of the problems that you will be faced with in the short term future. Money will no doubt be a problem, but at least everyone will know the consequences of not meeting specific goals.

All of these things need to be managed as a whole, to operate as an organized entity. Even with tight budgets and more work, failing to plan for the future may very well mean you may not have a job in the coming years. If you can not meet the need for change and provide an essential information service, you may well be a target for the budget axe. We can not afford to do the same type of things we did as a centralized computing facility. We need to keep up with the needs of our end users.

The Network Infrastructure Match at the University of Toronto

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ABSTRACT

By all measures the University of Toronto is a very large educational institution with a strong commitment to teaching and research. Achievement of the University's commitment can be furthered by a ubiquitous communications and computing environment. A campus-wide network infrastructure that can integrate voice, image, video, and data is a key requirement of such an environment.

The University of Toronto is not a fully-wired campus and there is a need to determine how to maximize the benefit of network infrastructure improvements. This is particularly true in light of the severity of the funding problems at universities - with no relief in the foreseeable future!

This paper proposes a framework that may be used by other universities and colleges to evaluate how network infrastructure improvements may be made in a organized and responsive manner. It recommends steps that should be taken to reach such a goal and identifies areas other than the network that may need to be improved.

I. Introduction

The Setting: The University of Toronto was founded in 1827 by a British royal charter. It is Canada's largest university with an approximate enrolment of 50,000 students of which 36,000 are full-time students and 14,000 attend part-time. There are approximately 12,000 faculty and staff, and 250,000 alumni. The operating and research budgets are $475 million and $250 million respectively.

The physical space consists of over 230 buildings with a total of more than 14 million square feet. The University has four campuses of which the St. George campus in downtown Toronto is the largest. Erindale College in Mississauga, and Scarborough College in Scarborough, are approximately 20 miles to the west and to the east of the downtown campus respectively. Each of these campuses has approximately 5,000 students. To the north of the St. George campus is the Downsview campus which houses the Institute for Aerospace Studies.

The Five Initiatives: **University of Toronto Computing and Communications (UTCC)** has identified strategic initiatives to focus resources and support the University's computing and communications environment. These initiatives are collections of smaller projects and day-to-day activities that guide the division towards a set of goals. Five of these initiatives are focused on undergraduate learning, administrative local office systems, institutional applications and their transition from 3270 technologies, high-performance computing, and library services. Each has varying demands on the network infrastructure. A rating system was devised to assess these demands and to identify how well current and future networking technologies could support these initiatives.

The Services: The five major initiatives that were identified will now be viewed from the service aspect. Table 1 lists the access requirements to two groups of information technology services: those accessible locally and those accessible remotely through the network. It rates as high (H), medium (M), and low (L) the dependence, in our judgment, of each initiative on the availability of a service. It can be readily seen that the success of the initiatives hinge on the availability of network-based services.

1. Local Access Services

File Sharing: For all of the initiatives except for high-performance computing, file sharing will refer to the traditional file sharing mechanisms such as is offered by Novell, Apple and Sun central file server products. Since high-performance computing applications typically require access to vast amounts of data storage many data servers need to be made available on the same LAN. Sun's Network File System (NFS) is an example of a product that allows for many data servers.

Shared Cycles: Shared cycles refers to the ability of a processor to perform work on a task that may not have been initiated by the processor itself. This service includes the simplified version of shared cycles, such as OS/2 client/server or Sun client/server architectures, and a more feature rich service that can serve the needs of high-performance computing and distributed computing. Shared cycles is of great importance to the High-Performance Initiative and to some extent is of relevance to the Undergraduate Learning Initiative.

CD-ROM Technology: This refers to the capability of a workstation on a LAN to access a CD-ROM device that is connected to the same LAN. This is of extreme importance to the Library Services Initiative and to a lesser extent the Undergraduate Learning Initiative. Some administrative staff could make use of this technology.

Printing: Users need access to a high-quality printer on the LAN that will support multiple type fonts, graphics, and that is readily accessible. This is a basic function that all initiatives need to address.

Database: It is very important that the users of the Library and institutional applications have access to a database on their LAN. This will reduce the University's dependence on monolithic time-sharing

Table 1: Access Requirements to Information Technology Services

INITIATIVE SERVICE	Undergrad. Learning	Local Office Systems	Inst. Appl. & Their Transition from 3270 Technology	High Performance Computing	Library Services
REMOTE ACCESS SERVICES					
Library Access	H	L			H
Electronic Mail	M	H			
Campus-Wide Info. Systems	H	L			H
File Sharing	M	L		M	
Distributed Databases		H	H		
Shared Cycles				H	
Video Conferencing	M	L			
Satellite Access	M				
CD-ROM Technology	L	L			M
LOCAL ACCESS SERVICES					
File Sharing	H	H	H	H	H
Shared Cycles	L			H	
CD-ROM Technology	M	L			H
Printing	H	H	H		H
Database		M	H		H

LEGEND: HIGH (H), MEDIUM (M), LOW (L)

systems and allow for autonomy where appropriate. Some of the data within the LAN databases will be part of an overall institutional database.

2. Remote Access (Network) Services

Library Access: Access to the services that the Library has to offer via the network is of extreme importance to the Undergraduate Learning Initiative and the general University community. Some of the services that are currently being provided by the campus network are the University's cataloguing system and access to the Medline database. Network accessible CD-ROM technology will undoubtedly play a major role in the Library's future.

Electronic Mail: Electronic mail refers to the exchange of electronic information on a University-wide basis. The short term goal is to support textual (plain text files) mail - the long term goal is to support multimedia mail. This service is of extreme importance to all of the University community and is critical

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to the Undergraduate Learning and Local Office Systems initiatives.

Campus-Wide Information System: The Library Services and Undergraduate Learning initiatives would benefit greatly from a campus-wide information system. Information that could be included in such a system are things like course schedules, exams from previous years, social events, discussion groups, and University policies. Faculty and staff could also benefit from such a service if it were to be considered one of the needs of the Local Office Systems Initiative. The information system would use electronic forms of text, image, and perhaps video.

File Sharing: To a lesser extent than local file sharing, remote file sharing is a desirable service. However, unlike file sharing within the LAN where there is a common ground for sharing files (that is, typically one file server protocol, but not always), there is a great diversity of proprietary file sharing protocols across the campus networks. The file sharing service that is envisioned for a network service would make such mismatches of proprietary protocols transparent to the users of the network. Such a service would be vastly beneficial to the Undergraduate Learning, High-Performance Computing, and Local Office Systems initiatives.

Distributed Databases: This service could allow users to view a database as if it were local when in reality the data may be stored anywhere across the network. That is, the location of the data repository or repositories is independent of the location of the computing processor (or set of processors). This is key in the transition of institutional applications from centralized IBM 3270-based applications to an environment that will support a variety of operating systems and communications protocols. This service would play a major role for administrative users of a local office systems environment by allowing the data to be stored where it is most appropriate, and by eliminating data re-entry.

Shared Cycles: This service would provide the same set of functions as the local shared cycles service and may only be required for the High-Performance Computing Initiative.

Video Conferencing: Video conferencing refers to the use of video and audio to support communications (at a distance) within work groups or project teams, and for the purposes of this paper, will include distance learning where a teacher may confer with one or more groups or individuals. Such a service could lead to new ways of sharing undergraduate lectures across campuses. To a much lesser extent, faculty and staff could make use of this service to improve person-to-person communications while performing their administrative and academic duties.

Satellite Access: The Undergraduate Learning Initiative could benefit by having access to remote broadcasts that are distributed via satellite. For example, students of a course offered by the Centre for Russian and East European Studies can currently view educational and news broadcasts from the Soviet Union. This service, which includes a rebroadcast and reception system, could be expanded to other undergraduate courses.

CD-ROM Technology: This service would provide access to CD-ROM libraries via the campus network. This would be of great benefit to the Library Services initiative, and to a lesser extent, the Undergraduate Learning and Local Office Systems initiatives.

II. What Is

Section II briefly describes the "What Is" by describing the current physical and network infrastructures and how these infrastructures support the provision of information technology services to the user community.

A. What Is - The Current Physical Infrastructure

The **physical infrastructure** shall be defined as the media (and its enclosures) that is used to transport raw bits over a communication channel. It includes copper wires, fibre-optics cables, punch-down wiring blocks, ducts, conduit, etc. It does not include "intelligent" devices such as concentrators, repeaters, routers or gateways.

Interbuilding Facilities: Interbuilding facilities are provided by the University's institutionally-owned cabling and by Bell Canada. The institutional cabling provides access to shared resources by connecting faculty, staff, and students to one of the three campus backbone networks as described below. The Bell cabling is leased by departments and is used primarily for voice and low-speed data transmission.

Fibre-optic and Twisted Pair Cabling: The University has been installing fibre-optic and twisted pair cabling between buildings since the early eighties to take advantage of existing underground steam tunnels. Underground ducts were also installed where access was not possible through the steam tunnel system. Typically, since 1985, the cabling installed between buildings has been 12 fibre strands and 100 unshielded twisted pairs (UTP). Of the more than 230 building included in the 4 campuses there are 27 (12%) buildings with fibre access and 36 (16%) with UTP access.

Coaxial Cable: There is still some minimal use of IBM coaxial cable for access to the administrative computer. Most of the installed base is no longer being used and has been removed in some cases to free space in underground pathways.

Airwaves: The University has a licensed broadcast antenna that is currently used to rebroadcast satellite signals to the St. George campus.

Leased Cabling: Departments lease low-speed point-to-point links to connect terminals and modems to terminal-switched facilities and for the interconnection of local area networks.

Intrabuilding Facilities: It is very difficult to assess the extent and profile of the intrabuilding facilities due to a lack of documentation that details the intrabuilding plant. One may characterize the blend as follows:

- there is a variety of wiring media including IBM coaxial, shielded twisted pair, unshielded twisted pair, IBM token ring cabling, thick and thin coaxial (ethernet)
- the wiring may or may not be in ducts, conduit, raceways and in some cases does not meet the building code
- the wiring has varied electrical and physical properties
- some of the UTP wiring that has been installed do not meet the minimum specifications of the "Standard for Building Wiring for Information Systems"

B. What Is - The Current Network Infrastructure

The **network infrastructure** shall be defined as the energized physical infrastructure plus the intelligent devices and communications protocols that allow for the end-to-end transport and packaging of raw bits over a communication channel.

Institutional Networks:

Backbone Networks: There are 3 major backbone networks that provide data communications capabilities. The Token Ring Backbone (**TRB**) and the General Purpose Backbone (**GPB**) provide the ability to interconnect local area networks at high speeds. The TRB operates at 4Mbps using the ISO/IEEE 802.5 token ring standard and the GPB operates at 10Mbps and uses the ISO/IEEE 802.3 Ethernet standard. Both of these backbones use fibre-optics throughout. The third backbone, the Terminal Switched Backbone (**TSB**), is an older technology and is basically a large data switch for switching low-speed terminal traffic to host computers primarily using the RS232-based interface. A small number of distributed remote shelves and main switching nodes form the heart of the TSB system and are typically connected together using fibre technology.

Centrex III: The University leases a large Centrex III network for voice communications. The only equipment that is owned by the University are the telephones. The wiring, switching system, management, etc., are the responsibility of the supplier. There are approximately 8,600 telephone numbers and 9,500 telephone sets.

Point-to-Point: Low-speed data communications lines are used to connect 3270-based terminals to an IBM front-end. Other uses of such lines are to interconnect campuses and to provide modem pools. Approximately half of the point to point links are owned by the University and the remainder are leased.

Satellite Reception and Rebroadcast System: The University established a satellite reception and rebroadcast system in 1990. This project is in its early stages of implementation and is currently being used to receive Russian broadcasts and to rebroadcast them to various points on the St. George campus.

Departmental Local Area Networks (LANs): Over 32% of departments have LANs of which most are connected to one of the backbone networks. There is a wide array of network operating systems, configurations, and products including token ring, ethernet, LocalTalk, Novell, PCLAN, DecNet, etc.

C. What Is - A Characterization of the Current Match Between Services and the Current Network

The Methodology: The following approach **sets a framework**[1] that will be used to rank infrastructure improvements according to their contribution to the five initiatives:

- assume that a **pervasive** infrastructure is in place using **current** network technologies and use a weighted rating to determine how well the access requirements of Table 1 could be met
- describe an ideal infrastructure (next section)
- assume an **ideal** infrastructure is in place using **future** technologies and use same rating system to determine how well the access requirements of Table 1 could be met
- determine from the results of the comparison which initiatives are more likely to benefit from infrastructure improvements

Scoring the Current Match:

Assume that a **pervasive** infrastructure is in place using **current** networking technologies. The first line of each cell of Table 2 represents a current match rating and is arrived at as follows[2]:

- rate how well each service can be provided by current networking technologies using a scale of 0-5 where "0" is not at all and "5" is excellent
- weight the rating as follows:
  - if need for service was L in Table 1 then score = rating multiplied by 1
  - if need for service was M in Table 1 then score = rating multiplied by 2
  - if need for service was H in Table 1 then score = rating multiplied by 3
- add weighted scores and express as a percentage of maximum possible score (Maximum possible score is 5, 10, or 15 if access requirement is L, M, or H, respectively.)

A low score indicates that either the current network technologies are not sufficient **and/or** that the area that requires improvement is other than the network infrastructure (e.g., administration of service, a service is not fully offered, software to provide service is not mature).

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[1] The purpose of this exercise is to illustrate how this mechanism may be used to reveal the areas that need improvement and to establish priorities. All ratings and opinions in this analysis are the author's own. The numbers in Tables 1 and 2 are the author's best judgment without the benefit of extensive study.

[2] The purpose of the second line of each cell is explained in section III.C.

Some Discussion of the Ratings That Were Assigned in Table 2

Ability of Current Technologies to Provide Local Access Services:

File Sharing: (rating: 4; except, high-performance computing: 2) For all of the initiatives except for high-performance computing, file sharing products provided by current technologies serve the needs of the LAN user very well. The administrative functions and tools for the file sharing environment and the way in which files may be shared across different microcomputer platforms are two areas that need improvement.

The ability for multiple processes to access files that are located on many "data servers" on a local LAN has an important role in the High-Performance Computing Initiative. This is an area that is being researched. The speed of existing LAN technologies may prove limiting. File sharing in the high-performance computing environment is likely to be implemented with closed architectures for the near future.

Shared Cycles: (rating: 2) The delivery mechanism for advanced forms of shared cycles beyond the traditional client/server Sun model is likely to be distributed/parallel processing. Only prototypes of such systems exist today. It would be very difficult to support the sharing of cycles in the High-Performance Computing and Undergraduate Learning initiatives at this point in time with anything other than the client/server model. Although current client/server models do not suffer greatly from network performance problems, it is unclear what impact distributed/parallel processing will have on the performance of the LAN.

CD-ROM Technology: (rating: 1) While this technology has been available for some time now, and some CD-ROM standards are in place, there are very few LANs on campus with a CD-ROM player attached to it. Additionally, CD-ROM titles (libraries), or at least the search software that a given title may use, are platform-dependent. There are likely to be performance problems on the LAN when video is used. This technology is not being exploited to its full potential.

Printing: (rating: 4) Most users have access to a quality printer in the LAN environment. Unfortunately, there are at least two popular standards for a printing protocol and it is therefore not always possible to print files from other sources (that is, other LANs or mainframes) on the local printer. In general, the printing services that are available to the LAN users suit their needs.

Database: (rating: 2) Users of the Library, institutional applications, and office systems access databases in the LAN environment. There are a variety of products available but the degree to which the product conforms to a true database system is always questionable. The major areas that need improvement are standards adoption, support, and the ability for local data to be part of a remote database. The speed of the LAN may be a hindrance for databases that support graphics and video.

Ability of Current Technologies to Provide Remote Access (Network) Services:

Library Access: (rating: 3) The Library provides reasonable information and access to the Library's holdings to the University community, and in particular, to undergraduates. Areas that need improvement are CD-ROM availability, access to networked resources, and access to electronic forms of Library holdings. Currently most of the networked access to Library resources is for catalogue searching. It is very unlikely that the current networking technologies could support full access (text, image, video) to the Library's holdings when they are made available in electronic form.

Table 2: How Well Current and Future Network Infrastructures Meet Access Requirements - Current Match and Future Match

INITIATIVE **SERVICE**	**Undergrad. Learning**	**Local Office Systems**	**Inst. Appl. & Their Transition from 3270 Technology**	**High Performance Computing**	**Library Services**
REMOTE ACCESS SERVICES					
Library Access	3(9,15) *4(12,15)*	3(3,5) *4(4,5)*			3(9,15) *4(12,15)*
Electronic Mail	2(4,10) *4(8,10)*	2(6,15) *4(12,15)*			
Campus-Wide Info. Systems	0(0,15) *2(6,15)*	0(0,5) *2(2,5)*			0(0,15) *2(6,15)*
File Sharing	2(4,10) *3(6,10)*	2(2,5) *3(3,5)*		2(4,10) *3(6,10)*	
Distributed Databases		2(6,15) *3(9,15)*	2(6,15) *3(9,15)*		
Shared Cycles				2(6,15) *3(9,15)*	
Video Conferencing	0(0,10) *3(6,10)*	0(0,5) *3(3,5)*			
Satellite Access	1(2,10) *2(4,10)*				
CD-ROM Technology	0(0,5) *2(2,5)*	0(0,5) *2(2,5)*			0(0,10) *2(4,10)*
Total Weighted Score	**19/75 (25%)** ***44/75 (59%)***	**17/55 (31%)** ***33/55 (64%)***	**6/15 (40%)** ***9/15 (60%)***	**10/25 (40%)** ***22/40 (55%)***	**9/40 (23%)** ***22/40(55%)***
LOCAL ACCESS SERVICES					
File Sharing	4(12,15) *4(12,15)*	4(12,15) *4(12,15)*	4(12,15) *4(12,15)*	2(6,15) *3(9,15)*	4(12,15) *4(12,15)*
Shared Cycles	2(2,5) *3(3,5)*			2(6,15) *3(9,15)*	
CD-ROM Technology	1(2,10) *2(4,10)*	1(1,5) *2(2,5)*			1(3,15) *2(6,15)*
Printing	4(12,15) *4(12,15)*	4(12,15) *4(12,15)*	4(12,15) *4(12,15)*		4(12,15) *4(12,15)*
Database		2(4,10) *3(6,10)*	2(6,15) *3(9,15)*		2(6,15) *3(9,15)*
Total Weighted Score	**28/45 (62%)** ***31/45 (69%)***	**29/45 (64%)** ***32/45 (71%)***	**30/45 (67%)** ***33/45 (73%)***	**12/30 (40%)** ***18/30 (60%)***	**33/60 (55%)** ***39/60 (65%)***

LEGEND FOR CELLS:		**Current Match**	**Future Match**
	a(b,c)	a = rating	*d* = rating
	d(e,f)	b = weighted score	*e* = weighted score
		c = perfect (maximum) score	*f* = perfect (maximum) score

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Electronic Mail: (rating: 2) Electronic mail is being widely used on campus today but it is not available (except for a small minority) in the desktop environment[3]. Additionally, there are many proprietary mail systems which do not interoperate. Products that do provide interoperability through a common interface are not as stable as vendors claim and may restrict the type of mail (e.g., word processing file) that may be exchanged. There is no support for multimedia mail via the network. Some things that need to be improved are security, directory services, support for campus-wide mail, interoperability standards and products, and support for multimedia mail. The current networking technologies are a major stumbling block to implementing multimedia mail.

Campus-Wide Information System: (rating: 0) No campus-wide information system can be supported. The bandwidth of the current networks would need to be increased to support a heavily-used system.

File Sharing: (rating: 2) Currently there is little use of file sharing across the network. The current networking technologies do provide the basic infrastructure, but the file sharing protocols (Novell, AppleShare, NFS, etc.) may prove to be problematic in a widely distributed network which supports network services other than file sharing. It is also unclear as to how the performance of the network might be affected. Policy and technical issues remain to be resolved.

Distributed Databases: (rating: 2) While there are many vendors that claim they provide distributed database products, in practice, the products provide only a subset of what is truly a distributed database environment. Some of the problems that remain unsolved are network scaling, distributed query processing, distributed transaction processing, and integration with distributed operating systems. Nonetheless, there are products that provide a reasonable subset of functions such that data may be distributed and replicated over a number of database machines connected by a network. One such product, Oracle, is being implemented at the University with the intention of moving towards distributed institutional database systems. There may be database performance issues due to the network delays of the existing infrastructure. Further research and product development is required to provide a truly distributed database system.

Shared Cycles: (rating: 2) The status and problems are the same as for the local access service.

Video Conferencing: (rating: 0) There is currently no video conferencing service primarily because the existing networking technologies in use at the University do not support the transport of video. However, even with such a facility in place, the costs of hardware and the fact that this area is in its infancy (particularly for distance education and desktop video conferencing) will preclude its pervasive use.

Satellite Access: (rating: 1) This service needs to be extended beyond its current use. In addition to expanding the service by installing additional equipment, policy decisions need to be made on the management of viewing access and the scheduling of signal reception. There may be some demand for a satellite transmission service in addition to the reception service. This service is in its early stages of implementation.

CD-ROM Technology: (rating: 0) There is no CD-ROM service available via the network. The Library is likely to be the provider of such a service and could use this technology to provide electronic access to its holdings. The technology and speed of the existing network will probably limit the type of information that may be accessed. It is unlikely that access to full-text, image, and video could be supported.

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[3] Access to electronic mail should be within the desktop environment. A user should not have to use terminal emulation to access mail facilities.

III. What Should Be

Section III describes the ideal physical and network infrastructures and how this ideal could improve the delivery of information technology services. In short, it describes the "What Should Be".

A. What Should Be - The Future Physical Infrastructure

The ideal physical infrastructure would consist of:

- intrabuilding cabling (fibre-optics and twisted pair) to the desktop as described in the "Standard for Building Wiring for Information Systems",
- interbuilding cabling facilities (fibre-optics and twisted pair) as described in the wiring standard, and
- intercampus communications facilities that would link together the four campuses.

It would have the following characteristics:

- based on international standards or guidelines where possible, and
- provide equal access to all.

B. What Should Be - The Future Network Infrastructure

The ideal network infrastructure would have the following characteristics:

- complete coverage and interconnection of the campuses including residences,
- integration of voice, data, image, and video at the desktop,
- support for sophisticated network services,
- network transparency (eliminating the need for the user to understand network protocols, implementation issues, etc.),
- based on international standards or guidelines where possible,
- fully functional remote access to the institutional network provided by an external provider, and
- provide equal access to all.

C. What Should Be - The Future Match Between Services and the Future Network

The next section continues with an analysis using the methodology described in section II.C.3 (The Methodology) to determine to what degree access requirements of users are met by the services provided by the ideal network infrastructure.

Scoring the Future Match:

Assume than an **ideal pervasive** infrastructure is in place using **future** network technologies (voice, video, image, and data integrated within one network). The second line of each cell of Table 2 represents a future match rating and is arrive at as follows:

- rate how well each service could be provided using the rating system described in previous section
- add weighted scores and express as a percentage of maximum possible score

Some Discussion of the Ratings That Were Assigned in Table 2

Ability of Future Technologies to Provide Local Access Services:

File Sharing: (rating: 4; except, high-performance computing: 3) The administrative functions and tools for the file sharing environment and the way in which files may be shared across the different microcomputer platforms are two areas that need improvement for all initiatives. This will not be improved by the ideal network infrastructure.

For the High-Performance Computing Initiative, file sharing capabilities (in a distributed computing environment) could be improved somewhat by the ideal infrastructure, however the ability to improve such a service lies with the research and software industries.

Shared Cycles: (rating: 3) The ideal network infrastructure would have some impact on improving the ability to support a shared cycles service in a LAN environment. However, distributed/parallel processing systems (the main vehicle for shared cycles) are not at a point where they can be implemented with support for multiple platforms and operating systems. This service could not be provided at the desired level of service.

CD-ROM Technology: (rating: 2) The ideal infrastructure would impact the ability to provide a CD-ROM networked service (especially for image and video traffic). Still missing are standards for storage access and retrieval, and networking. Additionally, there are administrative and legal issues that need to be addressed before such a service is viable. The provision of this service could be marginally improved.

Printing: (rating: 4) The ability to provide printing would not be improved by the ideal network infrastructure. Access to printers and printing protocols are the areas that need to be improved.

Database: (rating: 3) The ideal network infrastructure would improve access to databases containing images and video. Areas that need to be improved are standards adoption, support, and participation in remote databases. The ability to provide this service would only be marginally improved if the ideal infrastructure were implemented.

Ability of Future Technologies to Provide Remote Access (Network) Services:

Library Access: (rating: 4) The ideal infrastructure would support access to electronic information in text, image, and video forms. However, the basic functions of information storage and retrieval have still not been standardized. Additionally, it is unclear whether the current holdings, as opposed to the newly acquired, will be put into electronic form. Nonetheless, the Library does provide electronic catalogue searches of its holdings, and provides limited access to databases and CD-ROM technologies.

Electronic Mail: (rating: 4) While the ideal network infrastructure would vastly improve the capability to provide multimedia mail to the desktop, there are many areas that need to be improved and that are independent of the network. Security, directory services, support for campus-wide mail, and interoperability standards and products, are but a few of the components. Provision of this service would be noticeably improved by the ideal network infrastructure.

Campus-Wide Information System: (rating: 2) The ideal network infrastructure would noticeably improve the capability to deliver a campus-wide information system that is heavily used and includes electronic forms of images and video. However, the administration of the system is key to ensure that the information is timely and accurate. The mixed environment of computers and operating systems on campus will also prove to be a challenge.

File Sharing: (rating: 3) File sharing that is supported by the ideal network infrastructure would be improved since delays in the network would be minimized. The policy and technical issues need to be addressed with respect to what file sharing protocols will be supported.

Distributed Databases: (rating: 3) The ability to provide a distributed database system that is supported by the ideal network infrastructure would be improved. However, a lot of research and product development is required to provide a truly distributed database system. Additionally the administration of such a system is likely to be complex.

Shared Cycles: (rating: 3) The status and problems are the same as for the local access service although the ideal infrastructure would improve network delays.

Video Conferencing: (rating: 3) The ideal network infrastructure would vastly improve the ability to perform video conferencing. However, the costs of hardware and the fact that this area is in its infancy will preclude its pervasive use.

Satellite Access: (rating: 2) This service would benefit from the ideal infrastructure in that it would be possible to distribute the received satellite signal through the infrastructure rather than using receive antennae. However, the scheduling of the signal reception and the general administration of the system will still be problematic.

CD-ROM Technology: (rating: 2) The ideal infrastructure would support access to full-text, image and video, and would improve the rating of this service. However, standards for CD-ROM storage and retrieval mechanisms have not been finalized, and most of the Library's holdings are not readily available in CD-ROM format.

IV. Observations from Table 2

- a pervasive network infrastructure is not enough (see the discussions for the assigned ratings)
- network services will benefit more from infrastructure improvements implemented with future networking technologies than will local (LAN) services; that is to say, current networking technologies are less of a barrier to providing services in the local environment than in the non-local environment
- to some extent the maximum scores in Table 2 indicate where the money is best spent (although this should only be considered as a guideline); for example, support for Undergraduate Learning and Local Office Systems initiatives could be vastly improved by infrastructure improvements

V. The Road To The Future - Recommendations

Finally, section V provides some insight to get from "What Is" as described in section II, to the "What Should Be" as described in section III.

Much work needs to be done in order to provide sophisticated network services to the University community. Improving the network infrastructure is an extremely important part of this process but by itself will be insufficient. Four recommendations on how to proceed are:

1. Promote adherence to the "Standard for Building Wiring for Information Systems" to improve the intrabuilding infrastructure:

To date there are no intrabuilding facilities that conform to the wiring standard. The most notable omission is the lack of fibre in building pathways and to the work area (desktop) from the telecommunications closet. Additionally, much of the installed twisted pair wiring that is used by department LANs does not meet the specifications of the standard.

At a minimum the wiring standard should be aggressively promoted by
- assuring that new installations and major upgrades of LANs adhere to the standard, and
- assuring that plans for new buildings and renovations of work areas in existing buildings adhere to the standard.

A more proactive approach would also include
- educating the community on the importance of adherence,
- an identification and prioritization of buildings (including residences) which need improvements, and
- the development of a multi-year programme to allocate resources, such as funds and space for wiring closets and equipment rooms, to implement intrabuilding infrastructure improvements.

2. Apply a method, such as the one proposed, for assigning limited resources to institutional network infrastructure improvements:

Few if any of the interbuilding connections conform to the recently adopted wiring standard. Only 12% of the University's buildings have access to fibre and only 16% have access to twisted pair facilities. It is imperative that more interbuilding facilities be installed to meet the computing and communications demand of the University community.

To improve the interbuilding facilities at the University a multi-year programme should be developed to address the following:

- the allocation of resources including funds, personnel, and space, to make infrastructure improvements that adhere to the wiring standard,
- a prioritization of clients who would be best served by interbuilding infrastructure improvements,
- the identification of areas on campus that need the most improvement, and
- the alignment of infrastructure improvements with UTCC initiatives.

3. Formalize the specification of initiatives with respect to requirements for infrastructure:

Many of the initiatives assume that a suitable and extensive infrastructure is in place today when in fact this may not the case.

To assist in the process of determining where and when infrastructure improvements are most needed, the following should be identified for each initiative :

- the location of the clients,
- what high-level services (e.g, electronic mail, shared cycles) are required and when it will be technologically possible to provide these services; for services that can not be provided, it should be made clear what areas are insufficient (e.g, network infrastructure, policy, software), and
- a multi-year implementation schedule such that infrastructure improvements may be scheduled when most appropriate.

4. Construct an "information systems architecture":

Much more than a pervasive network infrastructure is required to provide a computing and communications environment capable of supporting the strategic initiatives identified in this paper. There are additional technological requirements such as hardware and software to support distributed databases, shared cycles, and systems that can interoperate. There are also non-technological components such as administrative functions, policies, and formal definitions of information services.

To formally address these additional requirements an "Information Systems Architecture"[4] should be constructed which would include the four major architectural sub-groupings defined by:

- an application architecture: the structure of business processes (coded into software) that process data for the organization, including acquired as well as developed programs,
- a data architecture: the structure or model of the information assets of the organization, principally databases,
- an information technology (IT) architecture: the structure of the underlying infrastructure that supports data and applications, including hardware, systems software, and communications networks, and
- a management and organization architecture: the structure and roles of people and processes that support the information systems architecture.

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[4] L. David Passmore, "Infrastructure Thinking", Ernst & Young Presentation at ComNet '92, Washington, D.C., January, 27, 1992.

Building an Effective Organization to Run a Campus Backbone Network

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The Ohio State University is the largest campus in the United States; consequently, its networking staff have experienced most problems that affect networking and communications groups on a campus. This paper will address the staff requirements of an effective and dynamic networking and communications organization. It will present a structure that can maintain a production-level network and still prepare for the future in a constantly evolving technology. The paper will emphasize the need for human funnels of information into and out of campus departments through coordination of departmenat LAN and network administrators. It will define the structure of such an organization as well as its cooperative relationship with supporting groups.

Building an Effective Organization to Run a Campus Backbone Network

by C. D. Jordan

BACKGROUND

The Ohio State University (OSU) has 54,000 students on its main campus in Columbus. OSU was one of the first universities to develop a modern campus network to meet the needs of computer data communications. The campus network is called SONNET, for System of Neighboring Networks--a name that reflects the interconnecting nature of the backbone network with building and departmental networks. The backbone network is a fiber optic, 80-megabit per second, Proteon token-ring network. This backbone is connected to over 110 main campus buildings, four regional campuses, OARNET (Ohio Academic Research Network) and CICNET (Committee for Institutional Cooperation Network--begun by the Big-Ten universities). More than 10,000 computers are connected to SONNET via building networks in the 110 SONNET-connected buildings. Even as the campus begins to plan for the next phase of networking, most of the original design and installation of the network is still working satisfactorily. The next phase of the campus network will have to meet the bandwidth demands of the growing number of users and the requirements created by more sophisticated network applications.

Over the years, installing and maintaining SONNET has passed through the recursive Campus Networking Process:

THE PROCESS

1. PLAN - Determine goals.

2. DESIGN - Develop a technical design that will meet the goals.

3. INSTALL BACKBONE HARDWARE - Install cables and network hardware.
4. INSTALL NETWORK SOFTWARE - Install central network services software.
5. INSTALL USER HARDWARE - Install user PC, MAC or workstation network hardware.
6. INSTALL USER SOFTWARE - Install user networking software.

7. TEACH USERS - Teach users how to get started using the network.

8. MONITOR - Monitor the network, collect and analyze network traffic statistics, answer problem calls and initiate trouble-tickets.
9. REPAIR - Troubleshoot, repair and maintain network hardware and software.
10. DISSEMINATE INFORMATION - Disseminate information about new network services.
11. CONSULT - Provide "network problem" consulting.

12. STAY INFORMED - Stay abreast of the evolving technology.

13. DEVELOPMENT - Expand services or begin the next phase, (repeat 1-12)

During the Process of installing and maintaining OSU's SONNET network, five key network function groups have evolved:

KEY FUNCTION GROUPS

Network Engineering & Technician Support
Network Analysts & Application Programmers
Network Operations Center (NOC)
Network Information Center (NIC) & Consulting
Departmental Network Administration Liaisons

Which department or departments perform these functions is not the critical issue. However, clear assignment of these functions and easy identification of who performs these functions has led to a smooth running organization and a stable network at OSU.

This paper will define the roles of each of these groups in the networking Process, their interconnecting relationships, from which potential departments the staff can be drawn and how we have divided the roles at OSU. During the early phases of the Process these five key function groups can be formed. But before the Process begins, there may be many disparate, but very interested network players on a campus.

THE PLAYERS

In order to be successful all the "critical-to-success" players need to be involved in the planning. This list of people will come from a different list of departments for each campus. To avoid domain clashing or finger pointing, get all the critical-to-success players unique to your campus at the planning table. The following is a list of groups and departments that have been involved in the early stages of networking on some campuses:

Computer users
Academic Computing Center
Administrative Computing Center
Computer Science Department
Math Department
Engineering College
Supercomputer Center
Computer Repair Department
University Telecommunications Department
Library
Physical Facilities - Electrical Shop
ANYONE WHO MIGHT FUND IT

START WITH A PLAN

To get things started the critical-to-success players need to decide and agree on four issues:

1. What services will be provided initially on the campus network?

    electronic mail?
    remote login (telnet) and file transfer (ftp)?
    dynamic address resolution (Domain Name Server)?
    access to the Internet?
    newsgroups (USENET)?
    on-line Library card catalog?
    access to administration data?
    electronic white pages (Whois, ph)?
    campus-wide information system (CWIS)?
    security authentication (Kerberos)?
    protocols supported on the backbone?
    etc.?

2. To whom will the campus network provide connectivity/access?

    connect each building?
    connect each college or department?
    connect each faculty office?
    connect each faculty, graduate assistant and staff member?
    connect public computer labs?
    provide universal connectivity - provide access for every faculty, student and staff member?
    connect to the Internet?

access from home?

3. Which leaders or departments will do the first four Key Functions?

Network Engineering & Technical Support
Network Analysts & Network Application Programming
Network Operations Center
Network Information Center & Consulting

4. And unless you are very lucky, who will pay for it?

But before a group of "players" can decide who will do the Key Functions, in question #3, they need to have a better understanding of these network function groups:

NETWORK ENGINEERING AND TECHNICAL SUPPORT

Network engineers can be involved in the networking Process no later than step #2, physical design of the campus network. Technicians' involvement may not begin until step #3, the installation of backbone cable and hardware. It becomes apparent that there are two distinct skills in this function group; however, to be successful these two subgroups of people will have to work closely and comfortably together. Together, they will design, install, configure, troubleshoot, repair and maintain the network cable plant and hardware. The cable plant may involve several different types of cable (fiber, coax, twisted pair, other), and if so, this will require greater expertise of the staff. The hardware will include bridges, routers, hubs, protocol converters, terminal servers, and switches. This group will also evaluate network traffic statistics, determine and resolve routing issues, and may assign network addresses through their maintenance of the Domain Name Service tables.

In addition, they will have to communicate with the Network Analysts--hardware and software people must always be in communication. They will report outages to the NOC (Network Operation Center), and follow-up on trouble-tickets initiated by the NOC. Routing or network addressing changes which affect user software will have to be communicated to the NIC (Network Information Center) & Consultants. Individuals may be requested to give presentations at DNA (Departmental Network Administrator) liaison meetings.

Outside vendors, the university Telecommunications Department, the Physical Facilities Department, the Computer Center and others may have the skills, or can be trained satisfactorily to do some or all of the above.

Since two distinct groups of personnel are described above (Engineers and Technicians), this functional group can also be very neatly divided between two departments. Or the functions can be divided among three groups, where one of the groups only installs cables. On a small campus, one energetic person and a few students may handle it all.

With so many universities facing budget cuts, if more than one department on campus installs cables, consolidation of this job may be an area to review. Many Computer Centers, including the ones I have been part of, were leery of Telecommunications Departments installing coax connectors and Electrical Departments installing fiber. These fears were reasonable; originally. But numerous campuses have found that with proper training in data cabling installation procedures, these departments can do excellent work.

As the line of "what is telecommunications" and "what is data communications" is merging, the function of Telecommunications Departments and Computer Centers have sometimes clashed. These are the clashes you want to avoid by coming to an agreement on who will do what. At OSU, the Academic Computing Services center has gradually decided that we don't really want to be "cable pullers". OSU's UNITS, the university's telecommunications department originally installed and maintained the campus fiber plant. Now that the majority of building networks are using twisted pair cable, a cable that telecommunications people have long experience with, it seems only natural to work with the telecommunications department for most cable installations. So the Academic Computing Services' Networking & Communications Division engineers the backbone and the senior engineer, (who maintains a close and successful relationship with the telecommunications department), orders cable installing service from the telecommunications department. Technicians of the ACS Networking & Communication Division install and maintain the backbone hardware.

NETWORK ANALYSTS AND APPLICATION PROGRAMMERS

Network Analysts, Network Application Programmers and Network Systems Support staff will develop, install, test and maintain the network software services that are identified in the Planning phase of the Process. These services may be maintained in a distributed fashion or on one machine. Sometimes this group of people may be the systems analysts of the central computers for the Computer Center. Sometimes a particular department such as the Computer Science, Math Department or Engineering College will maintain some of the services.

The Network Analysts will have to work with the Network Engineers.

The Analysts will have to keep the NIC and Consultants informed of how to access new services. They will need to report outages to the NOC, and they will have to investigate trouble-tickets reported to them from the NOC. On occasion Network Analysts or Network Application Programmers may be called on to give presentations at the Departmental Network Administrator liaison meetings.

Two types of skills are needed for this area: 1) daily maintaining of application software and 2) testing, installing, developing, customizing and recommending new services. Usually these two types of skills don't come in the same person, but both are critical for a stable, but dynamic organization. Sometimes the staff in the second category are your brightest people, but they may get you in the worst messes--often they are not interested in properly documenting their work and they may get bored with a project once the initial challenge is over for them. This is where the staff in the first category will save your job.

At OSU, these functions are distributed over several departments. Central Domain Name tables and Whois databases are provided by the Network Engineers. Some departments provide their own Domain Name Service, Mail and Newsgroups. Also many services, such as Kerberos authentication, Mail and Newsgroups are provided by the Systems Analysts of Academic Computing Services' Central Computing Division. OSU's University Systems, the university's administrative computing department maintains the Library catalog software. As information services is a developing part of networking, ACS's Technology Assessment staff provide some of the newer services, such as our Campus-Wide Information System and a Gopher service.

NETWORK OPERATIONS CENTER, (NOC)

The NOC (pronounced knock) is known to the outside world or the user community as a phone number to call to report a network outage. To the other network function groups this area is known as the group that monitors the network.

The NOC has three main functions:
1) Electronically monitor the network
2) Initiate, dispatch and verify closure of Trouble-Tickets
3) Answer the NOC problem reporting phone line

Two management decisions will have to be made. What kind of software monitoring tools will be provided to the NOC Operators, and what hours of operation will be offered by the NOC. These hours will have to be well publicized. There are about three levels of service to consider:

1) Monday through Friday, 8 am to 5 pm
2) Monday through Saturday, 6 am to 12 midnight
3) 24 hours a day, 365 days a year

At first, level #1 works sufficiently. But as the number of users grows, choice #2 becomes a necessity. Starting at 6 am so that a problem in the night is resolved before 8 am is better than waiting until 8 am when 100 users will call the NOC to report the same problem. Also, many students and researchers tend to prefer the evenings to work, both from public computer labs and home modems. When people come to depend on network services just as they do their telephone service, then providing the third level of service will be necessary.

The NOC Operators communicate with all of the other function groups: Network Engineers/Technicians, Network Analysts, Network Information Center & Consultants, Departmental Network Administrator liaisons and network users.

Who can do this job? These people must have good phone skills, good hearing, dispatch and diplomatic follow-up abilities, and be able to adequately describe the nature of a reported problem. For the latter reason most NOC operators also do a "first line" of remote troubleshooting of problems and/or attempt to duplicate the user complaint. Also, to avoid hundreds of calls reporting a known outage, scheduled and unscheduled network outages need to be properly posted to user newsgroups and DNA liaisons notified. The Computer Center that runs a central computing mainframe may have the night staff and the Computer Center's staff may have the best software skills for the "first line" troubleshooting. But who has the best telephone skills? The Telecommunications Department might. If Network Engineering is handled by the Telecommunications Department and they have 24 hour operators this may be a consideration. However campus operators do not normally have the time to do first line software troubleshooting. At OSU the integrity of the campus network is now so critical to researchers that we feel it is necessary for our campus to have a separate, specialized group that runs a 24 hours a day, 365 days a year NOC service.

NETWORK INFORMATION CENTER, (NIC)

The NIC (pronounced nick) informs users of new information available on the network, through publications, workshops and by organizing and running meetings for the Departmental Network Administrator (DNA) liaisons. Consulting also needs to be provided for user problems with communications software and network applications.

Often this group may be formed out of User Services or Microcomputing Consulting Groups. But increasingly some of these functions are provided by Librarians. These individuals will need to have great people communication skills. In addition, they will need a variety of platform skills in order to support: 1) DOS users, 2) MAC users and 3) workstation--UNIX or possibly VMS users.

The NIC staff will need to get information from the Network Engineers and the Network Analysts to pass on to the DNAs. In turn, a feedback loop of information about user understandings and capabilities will pass from the DNAs to the NIC, and from the NIC to the Engineers and Analysts.

At OSU, we have a separate NIC group in the Academic Computing Services' Networking and Communications Division. However problem consulting often occurs in ACS's Microcomputer Consulting group and the Distributed Services Division of ACS handles most problem consulting for workstations. As was said earlier these key network functions do not need to be placed all in one group or department, however they do need to be assigned and handled for a successful network operation.

DEPARTMENTAL NETWORK ADMINISTRATOR (DNA) LIAISONS

No matter how large or small a campus is a distributed group of DNAs is necessary. A Computer Center staff of 100 people can not reach 60,000 users and similarly, a Computer Center staff of 15 people can not reach 4000 users. As departments are connected to the campus backbone network, a liaison for each department or affinity group needs to be established. The choices for this person are often:

1) Department LAN (Local Area Network) Administrator
2) Faculty member
3) Student employee
4) Graduate Assistant
5) Secretary or Office Support Staff

The LAN Administrator, is the ideal choice, but many departments may not have such a position, yet. Once the novelty has worn off, the Faculty member, doesn't really have the time to do the job right. The Student employee on whom everyone has come to depend, will leave the job at the end of a few semesters. The Graduate Assistant will write great customized code that will not get documented and when this person leaves, the department will have more problems than with the Student employee. Many people will think the Secretary is a terrible choice, but that isn't necessarily correct. A well-chosen secretary, who enjoys using computers and does use them daily, if given proper network training, can do this job. Actually where secretaries often "top out" in a department, this can offer a new avenue for growth. Also, secretaries don't have the problems mentioned for Faculty, Students and Graduate Assistants. At OSU, we have all of the above attending our Network Working Group (NETWOG) meetings and filling the role of DNA liaison.

The DNA needs to be a liaison position to the NIC, and a point of contact for reporting network failures to the NOC. The list of DNA phone numbers, e-mail addresses, associated department names and their office locations needs to be widely distributed, updated once or twice a year, and made easily available to the NOC, NIC, Engineers, Analysts and to each other.

Therefore the DNA liaisons are critical people for distributing information to users. They also must be able to get new users "up and running". Therefore, they need to know how to install user network hardware and communication software. They will assign network addresses to the computers in their department and then report Domain Name Service (DNS) information to the staff that maintains the DNS tables. Sometimes the hardware installation is done by another department on campus such as Computer Repair Centers or the group which installs the user's network cable. The DNAs need to know how to contact this group. But to avoid unnecessary service calls, they will want to know a first line of troubleshooting and testing for network failures from their network.

USERS

Need to know at least these three things:
1) Who their Departmental Network Administrator is.
2) What the phone number of the NOC is.
3) How to contact the NIC--phone number, e-mail or office hours.

STAY INFORMED

All staff in the network function groups need to stay informed of the evolving technology of networking. This can be done several ways:

1) Attend regional or state network organization meetings.
2) Read publications such as Network World, LAN Magazine Data Communications, ConnecXions and others.
3) Attend society conferences and computer network shows: CAUSE,

EDUCOM, INTEROP, IETF, SIGUCCS, COMDEX or others.
4) Read newsgroups; assign the staff to read & reply to certain newsgroups, put this in their job descriptions.

THE CAMPUS NETWORKING PROCESS REVIEWED

Now that the roles of the function groups have been identified, listing where each group may fit in the networking Process becomes more apparent:

1. PLAN - Critical-to-success players

2. DESIGN - Network Engineers, Network Analysts & others

3. INSTALL BACKBONE HARDWARE - Network Engineers/Technicians

4. INSTALL NETWORK SOFTWARE - Network Analysts/ Programmers

5. INSTALL USER HARDWARE - Dept. Network Administrators, others

6. INSTALL USER SOFTWARE - Department Network Administrators

7. TEACH USERS - Department Network Administrators

8. MONITOR - NOC, Network Engineers

9. REPAIR - Network Engineers/Technicians & Network Analysts

10. DISSEMINATE INFORMATION - NIC and Consultants

11. CONSULT - NIC and Consultants

12. STAY INFORMED - Everyone

13. DEVELOPMENT - Everyone

Today a campus network is a growing and evolving service. When staff stay informed the international sharing of new ideas leads to testing a new idea on your campus. Successful development and customizing of an idea leads back to the planning stage for new and expanded services of your campus network. The planning of new services will lead to building a design that will meet the goals of the plan. Thus the process begins over again which makes this the recursive Campus Network Process.

CAUSE 92

TRACK VI

DELIVERING INFORMATION TECHNOLOGY TO EXECUTIVES

Coordinator: Linda A. Chiappe

Higher education executives today are expected to furnish many different kinds of information about their institutions, crossing all administrative and academic areas. This information must be accurate and current. Information systems professionals have an opportunity to help executives meet this challenge, and the papers in this track describe some tools and approaches for doing so.

ANALYTICAL PROCESSING AS EXECUTIVE DECISION SUPPORT AT THE UNIVERSITY OF MISSOURI SYSTEM

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The 1990s will see the rise of analytical processing based on select data elements warehoused as archival, integrated, and subject oriented relational records. LAN-based software will support managers and analysts in quickly creating "programs" of linked analytical and reporting tools dynamically exchanging data. Such a system is nearing the end of a two-year pilot project at the four-campus University of Missouri System. The project's goal is to produce a comprehensive warehouse of student, personnel, financial, and course data accessed by Metaphor's DIS software to support reporting and executive decision making. The project represents a fundamental change in the relationship among University System computing, System administrative offices, and data custodians for the independent campus-based transaction systems. The paper will place analytical processing in the context of executive decision support, report on the pilot of the U/IDS project, and will discuss DIS reporting and *ad hoc* capabilities.

As the University of Missouri approaches the end of its two-year pilot project to produce an executive decision support system for *ad hoc* queries, decision support, and reporting supported by an analytical processing environment, there is much that other institutions can learn from the University's experience. Among the lessons to be learned are those owing to differences between collegiate and corporate environments and problems associated with trying to move too far too fast. But more importantly, higher education faces many challenges that should force it to reconsider prior notions of executive information and decision support. At the national level, higher education faces poor public perception, severe budget deficits, ebbing demand, and growing gloom in the industry.[1] Locally, the demands can be far more challenging. In Missouri, the Coordinating Board for Higher Education has adopted a series of goal statements, developed by a task force composed principally of governing board chairs, that among other standards: establish institutional categories based on admission criteria, set the number of hours faculty will teach, control administrative growth, require annual reporting of outcomes assessment results, establish targeted graduation rates, and define a minimum number of degrees expected by every program with those programs not meeting the standard to be dropped. When faced with these challenges, luxuries that executives cannot afford include slow response and inflexible regular reports. Instead, higher education executives need a system designed to respond to specific concerns and policy issues in the short time frame in which they must make decisions. Management information systems are now reaching an evolutionary point where decision support professionals can contribute to the decision making process in a manner and within a time frame that should improve the quality of decisions made.[2] In general, this type of information handling has been called analytical processing.

This paper will discuss analytical processing as a logical next evolutionary step in decision support that was anticipated twenty years ago by leading institutional researchers. Second, the University Integrated Data System (U/IDS) project representing an agreement between the University of Missouri and IBM will be described. Of special emphasis will be discussion of the two major obstacles to the development of the analytical processing systems, the political environment and the problems inherent in integrating the on-line transaction systems of a university. Next, the paper will contrast the steps required in *ad hoc* reporting within current systems and within analytical processing while emphasizing gains in efficiency, quality and clarity in communication. The presentation will end with a brief slide show demonstrating the capabilities of the analytical processing system using DIS software and a discussion of the status of the project as we near the end of the two-year pilot. The discussion will emphasize lessons learned.

Analytical Processing

Analytical processing describes an environment where warehoused data is addressed through software that integrates retrieval, analysis and reporting functions.[3] For analytical processing to occur, the warehoused data and integrated software are required. Warehoused data is time variant data, integrated through unifying organizational structures. But as importantly, it is uniquely designed to support standard reporting as well as *ad hoc* requirements. Warehoused data in an analytical processing environment can be identified by three features. First, a warehouse of data is a collection of: data extracts, pre-processed conditional values, and pre-computed aggregates; much like frozen files. Its nature is one of values frozen in time and as such it is time variant instead of current. Second, the time variant information is integrated across transaction systems to support linking of data from each system: financial, personnel, and student information; through use of a common organizational structure. This is the first feature that distinguishes the data warehouse from a collection of frozen records. Third, the data resides in a relational environment that is designed to support reporting and *ad hoc* requirements as opposed to simply tracking transactions. The features of integrated data and a custom relational design to support reporting and analysis distinguish data warehouses from collections of frozen records, whether stored in relational files or as flat files.

To help clarify the distinctions, imagine that you want to build a warehouse of payroll and personnel information and student information. The first challenge is to identify the links that exist between the systems and to clearly establish them through and integrated structure. Three of the links that naturally exist are: (1) that many students are also employees; (2) that faculty teaching courses are also in the personnel records; and (3) that there are organization structures responsible for students, instructional activities, and employees. In a warehoused system, these features are linked through establishing a common organizational unit, like department, within which accumulated values can be reasonably linked. The second challenge is to build a relational system that uses the common structure to guide design. The data warehouse will not be used to enroll students or to pay faculty. Because it need not support on-line transactions, warehouse design can be built to support reporting and analysis. Once the warehouse is built, data are loaded at points in time consistent with official census reporting. Two other distinctions between a collection of frozen files and a data warehouse are the inclusion of elements to specifically support reporting and analysis and elements that are aggregate values. Elements that would be regularly used in reporting, but that are not individual transaction elements, and frequently used aggregates are computed and entered into the warehouse as it is created. For example, much enrollment reporting requires the determination of whether a student is a first-time freshmen according to Federal reporting definitions. Determining whether a student is a first-time freshmen requires examination of the relationship between several individual elements in multiple time periods. In building a data warehouse, the necessary processing is done once and a new element, "first-time freshmen," is established. Additionally, the number of first-time freshmen in a college or at a campus is an often reported value and is therefore compiled and stored as an aggregate. This preprocessing supports reporting and analysis applications.

In addition to requiring a data warehouse, integrated software for retrieval, analysis and reporting is also required. If the system is to be flexible enough to support the *ad hoc* and decision support needs of institutional executives, then the steps between retrieval and reporting must be accomplished as smoothly and as flexibly as possible.[4] Follow-up queries often ask for the same analysis to be repeated at different levels of a variable or with different restrictions. Integrated software allows the changes to be made, to the retrieval component in this case, and for the report document to be reproduced with the alterations in a nearly transparent and automatic manner. For example, a recent case involved standards for admission. The report produced to support decision making was a spreadsheet combining a variety of analyses for two different cohort groups. As the executives asked for the same information using different admission standards, the conditional statements were altered and the report was reproduced with very minor manual changes.

The necessity of warehoused data and integrated software is made clearer when analytical processing is viewed within historic context as an evolutionary advancement. As the batch processing systems of the 1960s gave way to the transaction systems of the 1970s one trend remained true throughout: reporting and *ad hoc* analysis were always afterthoughts. It was recognized that transactional systems could support enumerative reporting and various reports were developed as management information systems or in response to government mandated requirements. Following the PC/4GL processing revolution of the 1980s, it is now possible to view decision support activities in a new light.

Partly because reporting and *ad hoc* analysis were viewed as afterthoughts and partly due to the limitations of software and hardware in the past, there have been several information processing trends and developments on campuses that present challenges to building an analytical processing environment.

First, transaction systems have developed as essentially "private databases," where access is controlled by custodians who often behave like greedy owners but whose motivations are pure: there are issues of data integrity and privacy that must be protected, data elements and their interrelationships may be difficult to understand, and direct access is potentially dangerous and disruptive. In contrast, data warehouses are typically read-only collections of agreed upon and understood elements with English-like values.

Second, transaction systems have often been developed independently, following the *de facto* organizational structures necessary to support the transactions. For example, student information systems often follow academic structures that are different from the administrative structures existing in financial and personnel systems. These organizational differences hinder integrating information for cost studies and other purposes. In addition, the independent transactions systems are often supported by different data base software and accessed through different programming languages rather than being integrated and accessed through a common language.

Third, the necessity to produce consistent reports that support historical analysis requires frozen files that are fragile. Occasionally, entire years are lost. The read-only access to warehoused data and the routine maintenance of centrally supported systems help to prevent similar problems in analytical processing. In addition, *ad hoc* projects often demand that the databases be reestablished from frozen files before processing can occur. This rebuilding of the databases is expensive and the space requirements often restrict normal and ongoing operations.

Fourth, there has been a proliferation of databases. Many offices and individuals now maintain databases that bear only an indirect relationship to university records. They do this because the software they want to use requires it, it is a problem to quickly get the information from computing services, they wish to merge data from different transaction systems, or they want to add data that is not in the university's records. If the data warehouse has been well constructed, then user data needs have been anticipated. Also, if the software used gives users the control and flexibility they have experienced when working with microcomputer software, or if access to their preferred software is transparent, then the problem is controlled.

Fifth, the institutional research function has become fragmented. While not necessarily a problem or even a concern, inconsistency of reporting produces conflict that is made worse by competition among units for scarce resources. In an analytical processing environment, analysis relies on a shared data source thereby limiting arguments over who has the right numbers. Differences of judgement based on the data continue but the discussion can focus on the issues, not on data. In all these cases, analytical processing helps to alleviate information handling problems. There is, however, another problem that exists in higher education decision support that the *ad hoc* facilities of an analytical processing system can help to alleviate. That problem results from the myth of executive information systems as decision support tools.

It has often been suggested that the information needs of university executives can be anticipated, and if anticipated, can be programmed and produced on a regular basis. But, beyond the most rudimentary aggregates, packaged executive information systems are of little use in higher education for three reasons. The first is that university cycles are typically no shorter than semesters and an electronic system to convey new information rapidly is superfluous. Second, the information needs that can be confidently anticipated are relatively few in number and require no new reporting capabilities. Third, systems of packaged aggregates are unlikely to help the executive faced with issues like: poor public perception; severe budget deficits; and involved and active governing board members, legislators, and coordinating boards. The reasons that executive information systems, and management information systems in general, are of limited value in higher education are that the information contained in them very seldom directly and completely answer any specific need for information as policy is being considered. Also, the systems are not conducive to follow-up questions.

It is the position of this paper that it is time to rethink the management information system and decision support system paradigm. This position was actually anticipated by institutional researchers over twenty years ago.

> The concept of an analytical information system is appealing. A system in which accurate, consistent, and complete sets of basic data are produced automatically, stored conveniently, interrelated readily, and available as needed is certainly to be sought by any college or university.[5]

The reason that an analytical processing system supporting *ad hoc* activities is a better solution is that there is no value inherent in data. As stated by Sandin,

> From the point of view of educational administration, the general requirement of an information system is that it should achieve a flow of information in the forms and at the times needed for responsible decision-making. Decision making is an event that occurs at a determinate point in time. It is in the moment of decision that information is relevant. If the time schedule for the production of information is not in phase with the time schedule for decision making, and information system of even the finest design will have no influence on planning.[6]

Or more succinctly stated by McCorkle, "Data become informative when we have specific policy questions that need illumination and resolution."[7] It is the act of decision making that gives information value and that value is directly related to the precision with which it addresses the informational needs of the executive. In an analytical processing environment, decision support is now at a position where it can address questions related to issues with true precision and can readily support follow-up questions based on the prior response. Through this focused, iterative interaction, the value of information is greatly increased. It was to this end that the University of Missouri joined with IBM in a joint agreement to explore the possibility of applying Metaphor's Data Interpretive System (DIS) to executive decision support. Metaphor is a wholly-owned subsidiary of IBM but will soon have independent operational responsibility and will market DIS under the Metaphor brand name.

University/Integrated Data System (U/IDS)

The principal objectives of the joint agreement were to explore the application of DIS to higher education administration information needs and to examine the possibility of linking DIS and

IBM's Executive Decisions software. Toward this end, IBM contributed software and hardware valued at over $250,000 and the University of Missouri contributed two full-time computer analysts, computing charges, and microcomputer equipment and upgrades. The two-year pilot is tentatively scheduled to end in May of 1993. The project was to build an analytical processing system around a warehouse of data identified by the institutional research staffs of the University of Missouri campuses, system office personnel, and the custodians of each system. The review of these elements began in December of 1989. Almost immediately there was resistance to the project. The standard question was "What are you going to do with the information?" What was seldom understood was that if those involved could anticipate all the specific applications then the data warehouse would not be needed.

The process of gaining support for the creation of a data warehouse was one of gaining acceptance and executive sponsorship and working within the university environment to address the concerns of interested parties. Gaining executive support required an understanding of the management philosophy of the organization and styles of senior administrators. In particular, it was stressed that information was an asset to decision making and planning and was therefore an institutional resource like the faculty or laboratories. The difference in speed and quality of response to their information needs when extracts existed versus when the steps required use of the current procedure to create an extract, showed senior administrators the potential value of a data warehouse. Response took days when the extract existed and weeks when it did not.

Threats to the survival of the project were faced from the outset, first from campus institutional researchers then from campus custodians and faculty. To respond to access issues and to insure that data were comparable, accurate and complete, a series of data applications groups were formed. These groups were composed of the data custodians who interacted with the project team to review data element selection for likely value and to identify data inconsistencies. Even though the University centrally maintained corporate systems, each has been modified over time by campus persons and different treatment was often required to produce comparable information. Campuses also differed in the completeness of data do to local practices. The data applications groups worked with the project team of system institutional researchers, campus institutional research representatives, and central computing support personnel. The project team was the key working group and reported to a management group of vice presidents, respective associate and assistant vice presidents, and chancellors. The management group was responsible for review and evaluation functions. In addition to these administrative groups, an intercampus faculty advisory committee was formed to ensure that data were "properly used" by the administration and to protect the interests of faculty. Faculty interest was sparked by knowledge that information linking payroll records and course instructional assignments would be part of the system.

The warehouse was to be a collection of student information and course data, student financial aid data, payroll and personnel data, and financial accounting data. Student and course data were to be captured at the semester census point. The student data would be supplemented by degree completion and off-schedule activities on an annual basis. Student financial aid data were to be transferred annually in October. Course section instructor records were to be loaded four weeks after the semester enrollment census dates. Payroll and personnel data were to be transferred at the personnel census, October 31. Lastly, financial and accounting records were to be captured in October for the prior fiscal year.

These steps were required to form the data warehouse and were necessary but independent of the development of an analytical processing environment. Through discussion with local IBM personnel, the Assistant Vice President for Information Technology began to explore the possibility of using an integrated software product, Metaphor's DIS, a product with a long and successful history in the consumer package goods industry. The joint agreement between IBM and the University of Missouri was subsequently formed and the two-year pilot project officially began in May of 1991.

DIS uses a local area network (LAN) comprised of IBM compatible PS/2 computers. The DIS LAN consists of a primary file server, a database gateway server, a communications server, and at least one workstation. The DIS database can reside on the LAN's file server, or it may be located on a mainframe. If the database is on the mainframe, the communications server needs to be linked to the mainframe. At the University of Missouri, the data is located on both the LAN file server as well as on the mainframe. When a workstation requests data, the database gateway server will send requests to either the mainframe or the LAN file server. The retrieved data will then be sent to the requesting workstation.

It was decided to build the financial reporting component first then move on to the student information system, payroll and personnel system, and the financial aid. After two years, most of the extract programs have been written and DIS prototype structures have been created for the financial, student and course, and the payroll and personnel data. The prototype for financial aid is also being completed. Issues still unresolved include the prohibitive time required for some operations to run and whether alternative front end processors and other integrated systems might better fit this higher education environment. One issue that has been resolved is that an analytical processing environment is a good solution for executive decision support through *ad hoc* analysis and reporting.

Advantages of Analytical Processing

Analytical processing offers a much more efficient way of responding to *ad hoc* queries in an executive decision support environment. Fewer steps are required, fewer people are needed, the skills of the people participating in the response are less computer specific, and computing costs are greatly reduced. Responding to typical queries about students using previous processes at the University of Missouri required at least eight steps. First, analysts would determine the data needed to respond to the question and any likely follow-up questions. Second, a request would be made to the central computing staff for the data needed. Third, the central computing staff and institutional research analysts discussed data needed with the custodians to determine its validity and availability. Fourth, central computing staff would write or modify programs to recover data from the transaction systems. Fifth, registrars and registrar staff members would run the programs and create flat files. Sixth, the data would be made available to the institutional research staff who would process the data using high level statistical and reporting languages, correcting differences in data element treatments by campus. Seventh, the results would be transferred to independent spreadsheets, graphs, and word processor files. And eighth, a document would be prepared in response to the initial query and returned to the requester. Follow-up questions would require steps six through eight to be repeated.

In the analytical processing environment only two steps are required. First, analysts determine the data needed for the question and likely follow-up questions, directly analyze the data using integrated spreadsheets, graphs, and word processor files. Second, a report document is prepared in response to the initial query and the report is sent to the requester. Any follow-ups questions require that these two steps be repeated although most of the first step will be the same the second time. This fundamental change in procedure reduces response time from a minimum of one or two weeks to one or two days. The first gain is time. The second is in better use of the skills of the people participating in the response and a reduction in the number of people required to form a response.

Ad hoc response under the existing system requires personnel with three different areas of expertise. First, the institutional research analysts need to be versed in higher-level languages and microcomputer applications, and their formal training is in research design and statistics. Second, the central computing staff are expert in database processes and use lower-level languages. Third, the expertise of institutional personnel in the area or areas related to the inquiry, like the registrar and the registrar's staff, are required. Because the response is made within a university system environment of four campuses, a student information system-based query will usually involve a minimum of 10 to 12 people and require 5 to 10 person-days. In an analytical processing environment, only one or two people need be involved in the formation of any one response. A third gain is measured by lower computing costs.

Day-to-day computing costs are also greatly reduced for the campuses in an analytical processing environment. For example, student information system-based queries frequently require a re-creation of prior databases for short periods. The total computing costs for the university system can easily reach $1,000 just to re-create the database and extract selected data. In the analytical processing system, distributed computing greatly reduces billable costs. A more complicated query requiring information from more that one operating system quickly expands the number of personnel involved and greatly inflates costs.

Efficiency gains in an analytical processing environment are related most strongly to the existence of the data warehouse. In the creation of the data warehouse, discussion of unique element characteristics by campus and has already occurred. Those differences have been resolved, often through the creation of elements that exist only in the warehouse. In addition, the data have already been delivered and are ready to support analysis. While the data warehouse is of fundamental importance, integrated, object-oriented software like DIS greatly facilitates analysis and releases the potential of the data to support decision making.

Because DIS software applications are straight-forward, object-oriented application tools, minimal special training is required and no training in computer programming is needed. This ease of use means that statisticians, researchers, accounting analysts, and others can directly apply their expertise in response to the question without the need for translation. In addition, the computing resource requirements are distributed, reducing the burden and cost of using central computers and relying instead on microcomputers for much of the intensive processing. It should be noted, that although DIS is easy to use, it is probably unrealistic to expect most current institutional executives to form their own queries.

The use of an analytical processing system in a four campus university system produces many gains in the quality of analysis and communication with campuses. First, the data are shared among all participants. There is only one set of data to use, so arguments over whose numbers are best are limited to questions of data treatment and interpretation. Second, there are no black boxes. Data retrieval and analysis is an open process. Users do not need to be programmers to know exactly how data were treated in the analysis. For example, there are occasionally differences between program specifications and the actual program actions that can not be deduced by reading specifications. If you do not see the code then you do not know exactly what is occurring. You only know what is supposed to occur. Concerned others can also follow the treatment of data precisely. For example, campus institutional researchers can see exactly how the central offices manipulated their data. Third, data from various transaction systems have been integrated and the integration supports more complex, useful, and valid analyses. Fourth, costs are supported by central administration instead of by the campuses. While not a direct gain in quality, reduced costs encourage campus participation and interaction with the system, thereby indirectly improving the quality and completeness of the data and of the work done. Fifth, the data can be made available to a wider group of professionals with diverse talents. And sixth, the shared warehouse prevents the need for a proliferation of extract files and small databases.

Conclusion and Discussion

The challenges facing institutional executives require more timely information, treated in a more sophisticated manner, and focused on the specific issues at hand. Executives and external constituencies have a better understanding of the capabilities of computing and are not inclined to wait patiently, and postpone action, while a response is formed over two or three months. They expect the response in a timely fashion. If the response can be made within the decision-making time frame, then the data becomes information and has value. In fact, the executive may now see reason to make a second request to explore new possibilities. Through this quick interactive exchange, decision making is improved.

Analytical processing is only new in the sense that old ideas about analytical systems can now be supported due to hardware and software developments. An analytical processing model of executive decision support was anticipated by Sandin writing in 1977.

> But after many disappointing attempts, I myself have come to the conclusion that, at least for the short run, we are not well served by the conventional wisdom about total information system implementation in higher education. I believe that development of rational decision making in colleges and universities might be better served by a reduction of our aspirations for implementation of an information system and by concentration of our efforts on a limited series of steps which fall short of comprehensive design ... What can be achieved in the short run are the following tasks: (1) identification of the data elements that are the necessary basis for a comprehensive information system if such a system could be established; and (2) installation of procedures for collecting, maintaining, storing, and retrieving these raw and unanalyzed data. These are the first steps that must be taken in information system development. Programs for processing basic data and transforming then into usable information should then be created on an ad hoc basis in response to specific information requests from decision makers. ... The information system that will result from this strategy will not be a system, in the strict sense, at all. It will be a patchwork of reports derived from a unified data bank which can be readily and accurately accessed. But the information that flows from such a processing system, though a compromise of information system theory, will be of direct benefit to the quality of planning and management in higher education, for it will be generated in direct response to management demands.[8]

Sandin was exactly right. Executive decision support, specifically, and management information systems, generally, are able to correctly anticipate only the crudest of measures. They can also function well within closed, uniform processes like budget development. In contrast, the process of decision making requires more focused, tailored analysis. Canned programs can no more anticipate the precise analysis to support future decision making than decision makers can precisely anticipate the need for future support. It is executive decision making that must become better understood because it is the decision making process that allows data to become informative. When the data directly applies to the situational demands of the executive and is conveyed within the time frame required of the decision then data and data handlers become informative and valuable.

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The Reed Graphical Interface Project

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Abstract

During the past year, Reed College has begun development of a graphical user interface for its administrative computing system, using off-the-shelf software. Screens have been developed for use by vice-presidents, deans, department heads, and other staff members in a variety of offices, including admissions, students services, housing, registrar, business office, and campus events. This paper describes the Reed graphical interface environment and the ways in which it makes the administrative system more versatile, accessible, and cost-effective. The software technology used in the project is relatively inexpensive and portable, can run on both Macintosh and MS-DOS platforms, and is suitable for small colleges as well as large universities.

Interfaces and Functionality

When evaluating an administrative computing system it is often tempting to draw a sharp distinction between *functionality* and the *end-user interface*. In fact, however, the interface itself may be a key determinant of functionality. For example, if complex data can be retrieved and displayed easily then a system could be used during telephone conversations by personnel in admissions, student services, development, and so on. If such retrieval and display procedures are difficult to learn, cumbersome to make, or excessively time-consuming to complete, then the system would be inappropriate for this type of application, regardless of its other functional strengths. In essence, the interface either enables or constrains certain functional aspects of the system.

In the case of an *executive information system*, the user interface plays a critical role. Unless an administrative system interface is easy to learn and easy to use, most decision-makers in higher education — from managers to presidents — will simply avoid using it. It is far easier to obtain information indirectly, from an administrative assistant or other staff member, than it is to wrestle with a complicated query language. The lack of an adequate interface is one of the key reasons that so many college officers prefer to obtain information "the old fashioned way," by relying on staff members, rather than going directly to the database.

Taking note of this fact, many administrative software vendors have entertained the notion of adding graphical interfaces to their products but so far none has delivered such a package — at least not of the power or usability of the ordinary Macintosh or the Microsoft Windows interfaces. On the other hand, a number of third party software vendors have produced tools that make it extremely easy for colleges and universities to design, develop, and customize their own graphical interfaces with which to access commercial administrative systems.

Establishing a GUI Development Environment

As a small liberal arts college, Reed faces many challenges when it comes to providing the best possible administrative computing environment despite severe budgetary and staffing constraints. Daily decision support, as well as long-range planning, require that we make better use of our data-processing resources. In the past, decision-making at most levels has sometimes been hampered by our inability to provide precise, timely information directly to key administrators. Traditionally, requests for information from senior officers have been directed to administrative staff members who then search the database or generate reports; in many instances, those individuals are forced to call upon computing staff members to modify or prepare new routines to accommodate specific data retrieval requirements. With more and more emphasis being placed on staff size and staff efficiency, it makes little sense to preserve the traditional style of handling data requests when we have the technical capability of providing information directly to decision-makers.

In searching for a commercial design tool for constructing an administrative computing graphical interface, Reed identified seven key requirements:

- compatibility with a mainstream commercial package
- compatibility with different desktop platforms, including Macintosh and MS-DOS pcs
- compatibility with a range of database servers such as DEC, IBM, HP, SUN...
- compatibility with a client/server environment
- easy of use, minimal technical expertise requirement
- rapid prototyping capability
- low-cost

The tool we acquired to meet these requirements was Oracle Card from Oracle, Inc. As a graphical interface development tool, Oracle Card is compatible with the Banner administrative computing package from the SCT Corporation. It runs equally well on Macintoshes and MS-DOS platforms and screens developed on one platform can be moved to the other in a matter of minutes. No software modification is necessary, except for screen re-sizing if monitor sizes are substantially different. It supports a wide variety of operating systems and hardware platforms, including those listed above, and functions well in a client/server environment.

Most importantly, we have found that Oracle Card can be used with relatively little training. Once the development process has been mastered, new screens can be prototyped in a matter of days or even hours. The license cost is low enough to fit comfortably into a small college computing budget such as Reed's.

The Reed GUI Project

Reed is a private liberal arts college of 1,300 students, located in Portland, Oregon. It has approximately 140 faculty members and 240 staff members. Roughly half of the staff members require access to the administrative computing system to support their daily activities.

Reed began development of the graphical interface by inviting senior administrators and administrative department heads to describe the types of information they use — or would like to be able to use — on a regular basis. After establishing some general guidelines for menu bar organization, the use of colors, etc., we began development of the twelve prototype screens listed in Table 1.

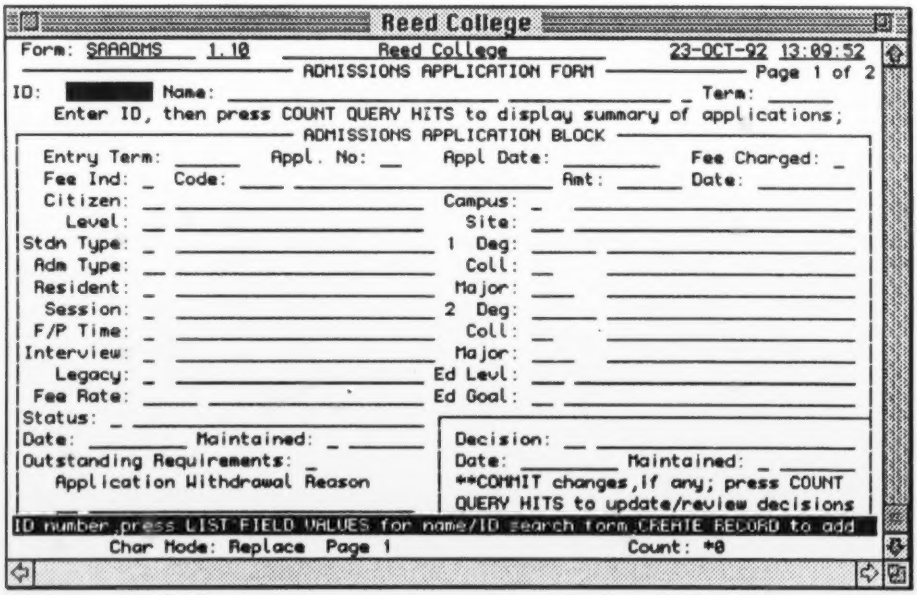
Screen Name	Office	Users
Admission Executive Query Form	Admission	Dean of Admission, Assoc. Dean
Applicant Information Form	Admission	Dean of Admission, Assoc. Dean
Applicant Status Report	Admission	Dean of Admission, Assoc. Dean
Prospect Information Form	Admission	Dean of Admission, Assoc. Dean
Campus Visit Form	Admission	Dean of Admission, Assoc. Dean
Budget Information Report	Business	Controller, Vice Presidents, All Department Heads
Financial Manager Report	Business	Controller, Assistant Controller
Faculty Schedule Form	Provost	Provost, Associate Provost
Room Scheduling Form	Registrar	Registrar, Campus Events Manager
Student Transcript Form	Registrar	Registrar, Associate Registrar
General Person Form	Student Services	Dean of Students, Assoc. Dean
Student Schedule Form	Student Services	Dean of Students, Assoc. Dean

Table 1 - Initial GUI Screen Development

Screen Customization

Our first goal was to use the graphical interface as a means of tailoring the retrieval and display capabilities of the system to the needs of specific users. Users often require information drawn from many different areas of the database. In a traditional administrative system, retrieving this information generally requires navigation through a hierarchical menu system in order to access a number of different inquiry screens. By selecting just the pieces of information required for a specific task, we can create a customized screen that is accessible by a single mouse-click from a pull-down menu.

Figure 1 illustrates one of the eight ordinary Banner screens that would be used by an admissions officer to find out information about an applicant. To access these screens the staff member could either navigate through a series of 20 menu selections or move directly from one screen to another by entering seven-character identification codes such as SAAADMS, SPRIDEN or SRBRECR.

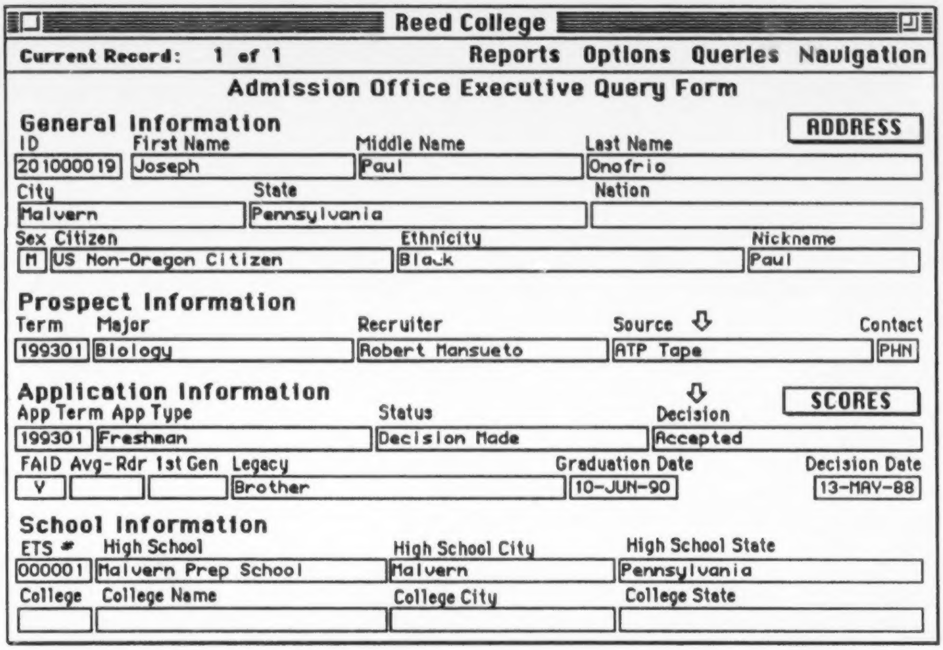


```
                              Reed College
 Form: SAAADMS    1.10    _______Reed College_______    23-OCT-92 13:09:52
 ---------------------- ADMISSIONS APPLICATION FORM ------------ Page 1 of 2
ID: [redacted] Name: ______________________ _______________ _ Term: ______
    Enter ID, then press COUNT QUERY HITS to display summary of applications;
 ---------------------- ADMISSIONS APPLICATION BLOCK ----------------------
|  Entry Term: ______   Appl. No: __   Appl Date: _________   Fee Charged: _ |
|  Fee Ind: _  Code: ____ _______________________ Amt: ______ Date: ________ |
|   Citizen: __ ____________________   Campus: _  __________________________ |
|     Level: __ ____________________     Site: ___ _________________________ |
|Stdn Type: _  _____________________ 1  Deg: _____ ________________________ |
| Adm Type: __ _____________________   Coll: __    ________________________ |
| Resident: _  _____________________  Major: ____  ________________________ |
|  Session: _  _____________________ 2  Deg: _____ ________________________ |
| F/P Time: _  _____________________   Coll: __    ________________________ |
|Interview: _  _____________________  Major: ____  ________________________ |
|   Legacy: _  ____________________ Ed Levl: ___ __________________________ |
| Fee Rate: ____ _______________    Ed Goal: __ ___________________________ |
|Status: _ ______________________  --------------------------------------- |
|Date: _________ Maintained: _ ____ | Decision: __ _______________________ |
|Outstanding Requirements: _        | Date: _________ Maintained: _ ______ |
|   Application Withdrawal Reason   | **COMMIT changes,if any; press COUNT |
|   __ ___________________________  | QUERY HITS to update/review decisions|
ID number,press LIST FIELD VALUES for name/ID search form,CREATE RECORD to add
        Char Mode: Replace  Page 1                      Count: *0
```

Figure 1 - Standard Banner Admission Application Form

Using the Reed graphical interface, a user could obtain all of the relevant information on an applicant by clicking on a pull-down menu, entering a name, and clicking on the FIND menu option. The graphical screen that would appear is illustrated in Figure 2.

The ability to pull diverse pieces of information together into a composite screen and to access that screen quickly and easily means that admissions staff members — from counselors to the dean — can use the database themselves, rather than having to rely on data specialists for information retrieval. Direct access to information of this sort — especially during telephone conversations — improves the capacity of admissions officers to deal with applicants or prospective students on a more personal basis. Being able to navigate from one screen to another simply by clicking on named menu items not only increases the speed of access but it eliminates the need to memorize complex screen identification codes.



Current Record: 1 of 1

Admission Office Executive Query Form

General Information

ID	First Name	Middle Name	Last Name
201000019	Joseph	Paul	Onofrio

City	State	Nation
Malvern	Pennsylvania	

Sex	Citizen	Ethnicity	Nickname
M	US Non-Oregon Citizen	Black	Paul

Prospect Information

Term	Major	Recruiter	Source	Contact
199301	Biology	Robert Mansueto	ATP Tape	PHN

Application Information

App Term	App Type	Status	Decision
199301	Freshman	Decision Made	Accepted

FAID	Avg-Rdr	1st Gen	Legacy	Graduation Date	Decision Date
Y			Brother	10-JUN-90	13-MAY-88

School Information

ETS #	High School	High School City	High School State
000001	Malvern Prep School	Malvern	Pennsylvania

College	College Name	College City	College State

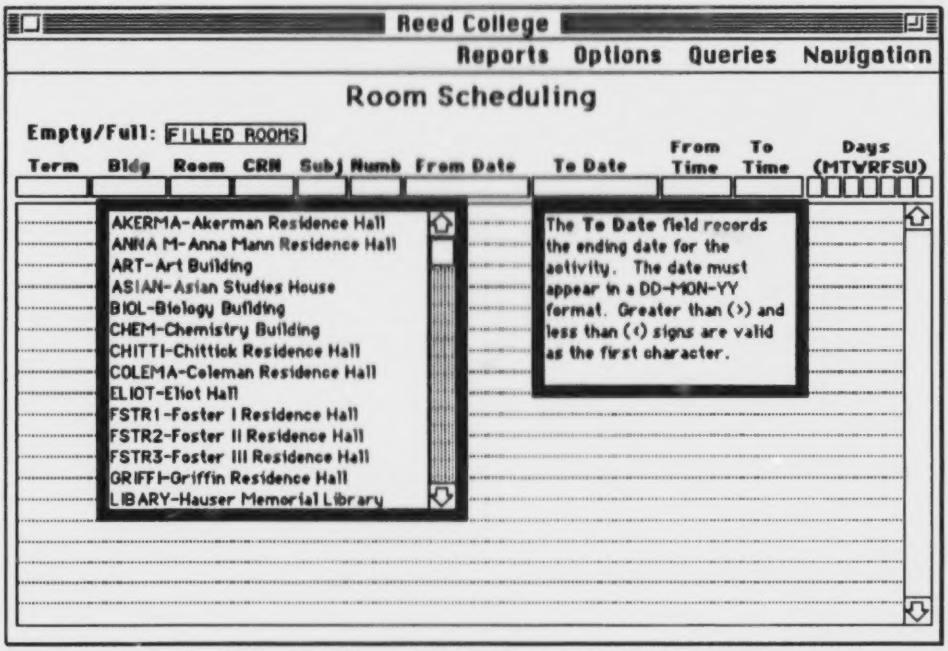
Figure 2 - Reed GUI Applicant Information Screen

Pop-Up Windows

One of the more cumbersome features of current administrative systems is the number of steps required to obtain the list of codes or values that must be entered in order to execute a search. In cases where a user doesn't know the exact spelling of a name, the correct abbreviation for a country, the current number of a course, etc., he or she may be forced to leave the inquiry screen, search through a list of possible values on a second screen, re-enter the inquiry screen, and insert the relevant name or code. Although data specialists usually know many codes and abbreviations by heart, senior administrators or department heads, do not. Casual users such as these are unlikely to bother with a system that requires them to do a great deal of memorization or to undertake a complicated process for scanning lists and retrieving field value information.

The Reed graphical interface eliminates both of these problems by allowing the user to click on any field and immediately see a pop-up window that contains a list of all the values that can be entered into that field. Clicking on a value will automatically transfer it to the inquiry screen and close the pop-up window. For example, Figure 3 illustrates a graphical room scheduling screen that can be used both for classes and extra-curricular events. In Figure 3, the user has clicked on the field marked "Bldg" to see a list of buildings that can be used as values for the location search parameter.

In response to the click, a scrolling pop-up window has appeared, showing a list of every building on campus. Clicking on an item, such as the *Asian Studies House*, will cause it to be entered into the "Bldg" field of the inquiry screen. When all the search parameters have been entered, the user can select the "Find" option under the Queries pull-down menu and a list of possible locations will appear on the screen.



Empty/Full: FILLED ROOMS

AKERMA-Akerman Residence Hall
ANNA M-Anna Mann Residence Hall
ART-Art Building
ASIAN-Asian Studies House
BIOL-Biology Building
CHEM-Chemistry Building
CHITTI-Chittick Residence Hall
COLEMA-Coleman Residence Hall
ELIOT-Eliot Hall
FSTR1-Foster I Residence Hall
FSTR2-Foster II Residence Hall
FSTR3-Foster III Residence Hall
GRIFFI-Griffin Residence Hall
LIBARY-Hauser Memorial Library

The To Date field records the ending date for the activity. The date must appear in a DD-MON-YY format. Greater than (>) and less than (<) signs are valid as the first character.

Figure 3 - Room Scheduling with Pop-Up Windows

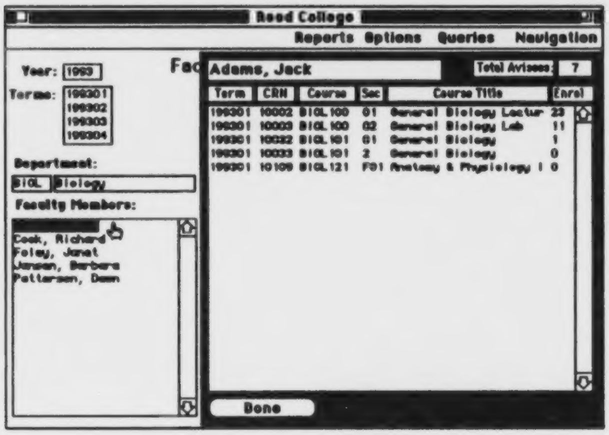
Notice also a second pop-up window in Figure 3 at the right side of the screen. This is a standard pop-up "help" window that explains the different fields and terms on the query screen. For new staff members or staff members who are unfamiliar with a particular screen, pop-up windows help to clarify the function and use of a screen without leaving the screen to consult on-line documentation or a printed manual.

Transferring Data to Desk-Top Utilities

One of the more tedious tasks of working in a networked environment is transferring information from the mainframe database to a utility program, such as spreadsheet, running on a desktop microcomputer. Though the concept of *downloading* is easy for users to grasp, the sequence of steps required to perform this operation is often confusing and may require assistance by computer center personnel.

In the Reed GUI environment, data that are retrieved from the server and displayed in one window can be moved to a utility in another window by simply selecting a transfer option from a pull-down menu. For example, suppose that the Dean wishes to examine faculty assignments and course load distribution using a spreadsheet. The graphical screen illustrated in Figure 4a displays the current course load for any faculty member, group of faculty, or an entire department. Once the Dean has selected the individual(s) or department(s) he or she wishes to review, a scrolling pop-up window displays the course assignment(s). Figure 4a illustrates the use of the screen to examine course assignments for members of the Biology department and Figure 4b shows the pull-down menu selection for transferring the data to the Excel spreadsheet.

With only one click of the mouse, the data is automatically transferred to the spreadsheet where it can be printed, encapsulated in an electronic mail message, or used on-line for modelling or planning purposes. Any type of information that can be retrieved from the database, such as addresses, text, lists, etc., can similarly be transferred to utilities such as word processors or other packages.



Year: 1993

Terms: 199301 199302 199303 199304

Department: BIOL Biology

Faculty Members:

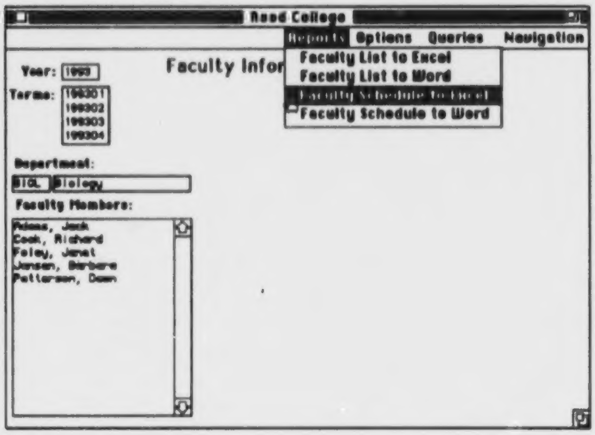
Cook, Richard
Foley, Janet
Jensen, Barbara
Pettersen, Dawn

Adams, Jack

Total Advisees: 7

Term	CRN	Course	Sec	Course Title	Enrol
199301	10002	BIOL 100	01	General Biology Lectur	23
199301	10003	BIOL 100	02	General Biology Lab	11
199301	10032	BIOL 101	01	General Biology	1
199301	10033	BIOL 101	2	General Biology	0
199301	10109	BIOL 121	F01	Anatomy & Physiology I	0

Figure 4a - Faculty Course Load



Year: 1993

Terms: 199301 199302 199303 199304

Department: BIOL Biology

Faculty Members:

Adams, Jack
Cook, Richard
Foley, Janet
Jensen, Barbara
Pettersen, Dawn

Figure 4b - Data Transfer to a Spreadsheet

Creating the template in a desktop utility to serve as the destination for a data transfer can be done by the user. Setting up a menu selection for the data transfer requires programmer intervention, but the amount of time is minimal, less than an hour on average.

In some cases, transferring data to a spreadsheet is unnecessary. Oracle Card can perform several basic mathematical operations that can be used to generate statistical information such as list counts, percentages, and so forth. Some of the applicant screens that have been developed for the Admissions Office take advantage of these features to provide running tabs on the applicant pool during recruitment activities.

Ad Hoc Inquiry and Reporting

Perhaps the most important benefit of the graphical interface is that it allows senior administrators and other end-users to perform ad hoc queries themselves and to generate their own reports, without computer staff assistance. Although many administrative operations are repeated on a daily basis, a great number of queries and reports depend on novel circumstances that require ad hoc solutions. In traditional environments, ad hoc requests account for a significant amount of programmer activity. Enabling staff members — especially senior administrators — to perform their own ad hoc searches not only frees up programmer time, it serves to empower users and gives them greater control over their information-based decision-making. Having direct and convenient access to the database means that senior administrators can entertain different planning strategies, understand the details of problematic situations, and make more informed decisions than they would otherwise be able to do.

With Oracle Card, we can provide administrators with the ability to select any combination of items from the database by means of pull-down menus. Selected items appear as fields on a blank "palette" screen where they may be ordered, sorted, and used as search parameters. For example, suppose that the Dean of Students is asked to arrange a Parent's Day panel discussion on undergraduate research projects related to the biomedical sciences. In order to select the panelists, the Dean may want a list of students majoring in biology, who are juniors or above, and who have grade point averages above 3.5. Selecting items such as *first name, last name, major, class standing,* and *grade point average* can be done by pulling down field menus, and clicking on the appropriate field. Figure 5 shows an ad hoc query screen of this sort being built.

Once the screen has been built, search parameters may be entered using standard comparator symbols (e.g., >= for "greater than or equals"), wild cards, and so forth. For example, to designate a search parameter to identify students who are biology majors, the user would enter "= 'BIOL'" in the "Majr Code" field. As with all Reed GUI screens, user's can obtain a pop-up window with an explanation of a field or a list of possible field values by clicking in the appropriate place.

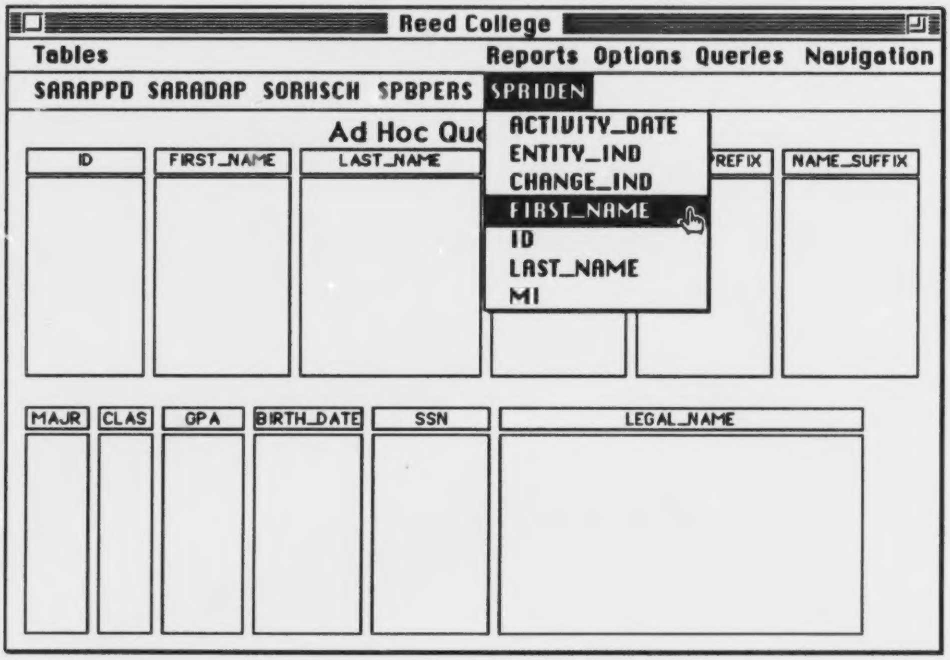

Reed College
Tables
Reports
Options
Queries
Navigation
SARAPPD
SARADAP
SORHSCH
SPBPERS
SPRIDEN
Ad Hoc Qu
ACTIVITY_DATE
ENTITY_IND
CHANGE_IND
FIRST_NAME
ID
LAST_NAME
MI
ID
FIRST_NAME
LAST_NAME
REFIX
NAME_SUFFIX
MAJR
CLAS
GPA
BIRTH_DATE
SSN
LEGAL_NAME

Figure 5 - Building an Ad Hoc Query Screen

Conclusion

Computer professionals and end-users who are familiar with the graphical interface provided by the Macintosh or MS-Windows tend to find the features of the Reed administrative GUI environment anything but exciting. Being able to navigate with pull-down menus, obtaining help from pop-up windows, and so on, are facets of computing that they have come to take for granted. Indeed, the project is not *revolutionary* but rather *evolutionary*. It merely brings to the administrative computing environment the convenience and ease that users have already enjoyed for many years in the academic computing environment. Perhaps the only surprising aspect of this effort is that administrative software vendors have taken so long to recognize the benefits that a graphical front-end can provide for their clients. Among the most obvious benefits are these:

- A vastly reduced learning curve for new staff members
- Empowerment of end-users to control their own data needs
- Direct access to database information by a new class of users
- More efficient use of administrative computing staff time

Despite the speed at which the Reed GUI Project is progressing, we are still in the early stages of exploring the full capacity of a graphical environment for administrative applications. Eventually, we expect to to use this technology to build Campus Wide Information Systems that can provide convenient access to a broad range of information sources for the entire college community. Given the cost-effectiveness, portability, and simplicity of current graphical interface tools, their use in administrative computing environments should become increasingly commonplace during the next few years.

Appendix: The Reed Administrative Computing Environment

The Reed administrative computing environment consists of a DECSystem 5500 database server running ULTRIX, the DEC implementation of the UNIX operating system. All administrative staff and officers of the College are provided with Apple Macintosh microcomputers. A client-server architecture is supported by a 10BaseT network that links the Macintoshes to the DECSystem. The TCP/IP protocol is used for network communication. Figure 6 illustrates the basic network design.

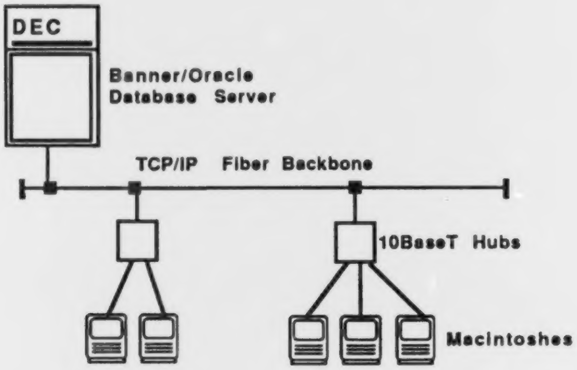


Figure 6 - Reed's Administrative Computing Network

Each Macintosh uses Versaterm for terminal emulation to access the standard Banner interface and Oracle Card for the graphical interface. Oracle's SQL*Net is used for TCP/IP communication between Oracle Card and the Oracle database on the server. The server runs the Banner Student, Finance, and Alumni/Development modules over the Oracle database engine. A migration of the database server to DEC's Alpha/OSF-1 platform is scheduled for mid-1993.

Acknowledgements, Shareware, and Further Information

Reed College gratefully acknowledges the support of the Digital Equipment Corporation (DEC), the Systems and Computing Technology Corporation (SCT), and the Oracle Corporation for their support of the Reed Graphical Interface Project[1].

Reed College will provide its graphical interface screens to all SCT clients or prospective clients for free. For information, please contact Martin Ringle at: Reed College, 3203 SE Woodstock, Portland, OR, 97202-8199; Tel. 503-777-7254; Fax 503-777-7778; Internet E-mail: ringle@reed.edu.

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[1], The following terms used in this paper are registered trademarks: *DECsystem 5500, Alpha, ULTRIX* (DEC), *Macintosh* (Apple), *Windows, Excel* (Microsoft), *Oracle, Oracle Card, SQL*Net* (Oracle), *Banner* (SCT), *Versaterm* (Synergy Software).

THE ELECTRONIC FACTBOOK
THE FOUNDATION FOR A UNIVERSITY WIDE DECISION SUPPORT SYSTEM

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Administrative Information Systems
Louisiana State University

Barbara F. Evans
Assistant Director
Administrative Information Systems
Louisiana State University

Over the past decade, LSU Administrative Information Systems and administrative departments have worked together to build operational data systems that meet the University's day to day needs. At the present time, we have 45 production systems to manage administrative functions such as payroll, personnel, purchasing, accounting, student records, admissions, and many others. High performance transaction processing and management of large data bases is well documented in theory and practice at the University. Although most of our production systems are heavily integrated, the data is generally associated with the applications that create it initially. Within this local context, the data is well understood and meaningful. Increasingly, however, there is a need to view all this data more comprehensively, to see it as a *totality of information*, understood and integrated at the enterprise level. The University is faced with competitive pressures, and has an increasing need for better and faster decisions based on accurate, timely, broad-based knowledge.

To address the operational needs of the Univerisity, we have built a multi-faceted complex environment with many data processing activities, a wide variety of applications, data types, access techniques and storage methods. This operational data may be in standard flat file format on either disk or tape, in key sequenced VSAM files, in IMS hierarchical databases, or in relational DB2 tables. Additionally, we also have an assortment of PC and LAN databases set up in Dbase, Rbase, OS/2 Data Manager and others. This complex environment, generated by growth and the evolution of technology, has resulted in making access to operational data awkward, generally requiring a non-user friendly programming language and requiring the information worker to know details about the data's physical location, its storage and its format in order to get at it. Our operational data often exists in sequential files or hierarchical databases, in a format that cannot easily support quick queries. What would appear to be a simple query can generally involve data processing staff and business analysts to assemble the answers resulting in decreased productivity, higher cost, and lost opportunity. A related problem exists with data being used by high volume real-time production systems. Unplanned or poorly structured querying of the data can degrade performance of the primary transactions. Even when we may know the location of the data, the form it is in, and know how to access it, there can be problems. Historical changes in data values and data that is algorithmically derived makes it sometimes difficult to understand or interpret operational data correctly. An example of this situation is the fact that there used to be four sex codes for students incorporating marital status into the sex code. When the database systems we now operate were developed, this code was split into two separate fields.

The LSU Council of Vice-Chancellors and the LSU Office of Budget and Planning have challenged AIS to develop a decision support system which transcends the complexity of our operational environment. Our task is to establish a comprehensive system to provide aggregate and detail information for effective decision making regarding students, personnel, finances and facilities. With a project dubbed the 'Electronic Factbook' we intend to build the *foundation* of a long range plan for a University wide decision support system. Additionally, we are increasingly requested to provide information in a distributed environment. With the rapid growth of PC's, and local area networks and the increasing sophistication of PC software, we must be able to provide this information to users on a platform where they are most comfortable.

Our goal, then, is to integrate and consolidate our operational data from disparate sources, formats, and versions into a unified information base. Once this has been accomplished, the results, with the proper tools, can be distributed to the desired environment for the most effective use in decision making. Given our complex environment, and our ambitious goals, our vision was to develop a system in which we could provide seamless access to information regardless of format or hardware platform in both a traditional mainframe and rapidly growing PC environment. This information would be presented by means of a common user interface with the point and click feel of Windows or Presentation Manager, graphical displays, hotkeys, and drill down menus. This system would be fast, reliable, require little user training and otherwise be transparent to the user.

Definitions of decision support systems abound, but formally can be described as interactive computer based system designed to help decision makers use data and models to solve unstructured problems. An executive information system on the other hand, focuses, organizes, aggregates and extracts essential information from extensive data sources delivering that information in formats useful to top administrators. These systems follow a step ladder of complexity, beginning with electronic delivery of reports, to customized reports (new perspective of old data), to variance analysis, to what-if processing and finally to modeling, where not only can the data be changed, but the relationships among the data.

In response to our challenge to build a decision support system, we began by employing Entity Relationship Modeling, which is one of our standards of system design, regardless of application. During this phase of application development, the business process is analyzed and the 'what', not the 'how', is defined. The results of these modelling sessions are the entities that will ultimately be the building blocks of the application. We went into the sessions, expecting to model processes of students, finances, personnel, and facilities. We found, however, that this project was different than modelling a business application. It was much more abstract. What we found were that our entities were information sets and source data about these four areas of focus. About the same time as we completed our modeling, IBM announced the Information Warehouse framework. This framework is not a product, but rather an architecture for building the type of system we are discussing. It defines a set of database management systems, interfaces and tools to deliver reliable, timely, accurate *information* to those who need it. What excited us was that the result of our modeling efforts were in direct accordance with IBM's Information Warehouse concept and enforced our belief that we are on the right track.

One of the things the sessions pointed out was there are two parts to our model. On one end is the raw source data generated at the operational level and on the other there are the information sets that are of interest for decision making. So, we began investigating tools and products to help us get from one end to the other. In our research, we found that these products generally fell into three categories:

1) One set of products, generally at the PC level would take our high end information sets and allow us to display them in a 'glitzy' manner employing decision support capabilities.

2) Another set of products would provide for direct access to disparate data sources.

3) 'Frontware' products that did neither, but allowed us to develop front end graphical displays to existing mainframe applications.

In the area of decision support software for the PC environment, there are many. Seventeen products were listed in a March issue of PC Week, ranging in price from $100 to $15,000 with about that much diversity of capability and features. We investigated some of these, such as IBM's Personal AS, Pilot's Lightship, and Channel Computing's Forest and Trees. Most of these products claim access to information on a variety of PC data formats and are impressive in their presentation and flexibility. But, they have their drawbacks as well in that some either expect data to be extracted to the PC environment or require certain modes such as DOS/Windows. In some cases, host data can be accessed, but requires the purchase of additional gateway software.

Since one of our primary concerns was data access, we investigated products that would allow for the seamless data access we desire. A product from Information Builders, Inc. called Enterprise Data Access (EDA/SQL) claims to provides the ability to find, retrieve, join, and update data on any database, regardless of underlying structure (DB2, IMS, Oracle, Rdb, etc.) located on any hardware platform. This product is sort of a universal query translator/router. It translates in-house front end data access applications into SQL queries and then locates the appropriate database and routes the query. Supposedly, it can be installed on all types of platforms on our network, from the most remote PC to the mainframe, letting us query any database stored in any location. It sounds like just the product we need to solve our needs. But, with a price of approximately $200,000 with a 15% maintenance fee, the product no longer seemed so magical. Additionally, there was no indication of the impact conflicting direct access would have on our production systems, or how it would solve the problem of currency.

Other products were investigated to allow us to provide a graphical interfaces to the information we wanted to display. A product from the Easel Corporation would allow us to build intuitive graphical interfaces to our host based applications. One of their products allowed for building templates to access and graphically display information from reports run on the mainframe and from that charts, graphs and variance analysis could be produced. This family of 'frontware' products, which were impressive in presentation, required the purchase of several modules, and introduced yet another programming language and compiled code that would have to be maintained by a member of the data processing staff.

As one can see, when we start envisioning a system as ambitious as the one first described, it *is* possible to access our enterprise data utilizing universal query translators/routers accessing data regardless of platform or format. It *is* possible to graphically display and multimedia format the results. It *is* possible to find software that will allow analysis and modelling.

Much of what we would like to incorporate/utilize in the decision support system we envisioned is attainable with significant outlays of funds for software in the investment of support technology. But, technological possibilities do not address financial restraints facing our efforts. With this project, we found we must separate what is idealistically desired and what can be practically realized.

More importantly, none of the products reviewed and none of the vendors interviewed addressed the fundamental problem of building our information base. We found we had to build the integrated, consolidated information base before we could address the issue of presentation or on-line access. Using the framework that we have with our existing IBM products, and IBM's structure for including new and future products we are beginning to lay the foundation for our information base with the tools we have on hand, DB2, QMF and SAS. Building our information base involves the selective duplication of desired operational data, subsetting it into that which is of value for informational purposes and needed for fast or shared querying. This data may go through transformation from its original format to a single common format and then this disparate, but related data, will be merged into a common information store, during which it may also be enhanced.

LSU is proud to announce that we have entered into a jointly defined effort with IBM ACIS to accomplish our goals and develop the Electronic Factbook. Our development efforts intend to demonstrate the feasibility of designing the foundation for a cost-effective, multi-platform decision support application.

So what is the electronic fact book and how do we begin? The Electronic Factbook, is a canned set of 100 or more queries, or fact sheets, which will be used by University administrators to support decision making efforts and which will be used by the University community at large to describe the current state of the University. The factbook is the upper section of the decision support pyramid. The project entails identifying and building these 100 or more queries and building the infrastructure to support the queries. It is anticipated that the Factbook queries will satisfy between 60-80% of the requests for information that administration is processing today. The infrastructure will serve as a foundation for a comprehensive, dynamic decision support system.

Our development tasks are divided into two distinct tasks or phases:

1. Pulling together data from a variety of sources, transforming the data into information and storing this information in a standardized information base that is accessible by an easy-to-use access language. This is the labor intensive phase of the task and the primary cost is man-hours and commitment.

2. Providing access to the information base on a variety of platforms (both mainframe and PC). This is less labor intensive, and the cost are in hardware and software. It is this phase that will appear glitzy and slick and satisfy a broader spectrum of users.

The first phase of the project is absolutely essential to a successful implementation of the fact book and to any future attempts at a decision support system. The first phase must be done before the second if the factbook is successful in the long run. Many vendors would indicate otherwise.

Our first step in pulling together data from disparate sources was to establish DB2 as the standard of the unified information base. We established this information base separate and apart from the operational data of the University for several reasons:

1. With DB2, we are able to easily meet our objective to provide a common data access language that can be used in a de-centralized manner - that language being SQL. SQL can be used directly to access data through facilities such as QMF on the mainframe, Query Manager and Forest & Trees on the PC. It can also be embedded into languages such as SAS and COBOL. In the fact book, we envision a standard set of queries which will be written in SQL.

2. Modifications to DB2 tables can be done with less impact on what's already out there. In the past, programs that were used to create the factbook, one year could not be used the next. DB2 provides much more flexibility in this area.

3. A separate DB2 information base will result in minimal impact to the production systems. Direct data access tools described earlier allow the user to access production data from a variety of platforms at cost to the production environment. Additionally, these products are not designed to capture point-in-time data or trend analysis data which is at the very heart of the fact book.

4. DB2 is designed for distributed data access. DB2-OS2 data manager

The second step in developing a standardized information base is to build atomic level information sets from targeted production systems. We are at this point in the process now. At LSU, rather than having 20 years of experience in producing university factbook, we have 1 year of experience 20 times. This is because administrators and computer personnel are operating in a changing environment. The structure of the operational data is constantly changing to take advantage of advances in technology, to respond to the business needs of the University and to respond to external regulations. Even if the University would attempt to freeze its operational environment, the federal and state governments would dictate that we make changes in such areas as financial aid and payroll. With the factbook we intend to reverse this process. Instead of collecting data from our production systems for the factbook we plan for production operational systems to deposit information into the electronic fact book. The factbook will dictate the format of this information, not the operational systems. At this level, the data in the factbook will reflect the nature of the database, there will be one record in the factbook for each occurrence of entity in the data base. As such these atomic level information sets will be large.

The next step in building the information base is a transition step in which data from the atomic information sets will be aggregated into higher level information sets at the curriculum, department and college levels for example. Once this data has been aggregated the atomic level information set is migrated to tape/cartridge. The aggregated information sets serve as the source for the 100 or so queries which comprise the factbook. Only after we have built this foundation do we intend to provide access to the factbook from a variety of platforms.

While the project is still under development, we are convinced our efforts to develop the electronic factbook will be successful. As with our operational data systems, we have started by building a solid foundation. We do not expect our initial efforts to be obvious to the average user near term. However, as indicated by our success with the operational systems, our clients will be much more satisfied with our long range results as the product will be of much higher quality and will come much closer to meeting their requirements.

OUTSTANDING PROBLEMS

- Multiple Registration Status 434433456, 437845328(sum ug,fall grad)
- Update Log
- Look at one SRR read subroutine and one ASN read subroutine
- Put scholarship fields in one code table and take code out of FAD8008.
- New Residence Codes
- PF Keys for screens are not consistent.
- Look at duplicate screens to see if can eliminate ssn search.
  399-66-8348 and 434-29-1987
- Convert on-line programs to use DIR9914 when ADM installed or next conversion.
- Does RECALC compute pell amount only when given the right calc code.
- FAD4016 (CSAP Letters) need to verify job on HRM.
- Move 'DISBX' security from FAD9916 to FAD6034
- Convert FAD-21-01 and FAD-21-06 to use backup file and not FAD.FINSTATE for dupe CFAR check
- Create FAD.PRINT_LOG to schedule printing instead of rigging FAD.DOCUMENT.
- Move Exit Interview Field from FAD.LOAN_TRACKING TO FAD.STUDENT
- Split FAD6018 into two programs
- FAD purge
- Edit FIN-YEAR in front end subroutine for valid year
- Convert FAD1016 and FAD1021 from COBOL Report Writer to SAS.
- Move to SAS607

Desktop Technology Frontier: Deploying an Office of NeXT Workstations as the Administrator's Workstation of the Future

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M. Katie McGee, *School of Arts and Sciences*
University of Pennsylvania
Philadelphia, PA

December 4, 1992

The NeXT workstation represents the state of the art in graphical user interfaces for desktop computing. The University of Pennsylvania's School of Arts and Sciences recently deployed NeXTstation in the Office of the Dean for the dean and her staff. In conjunction with the Office of Information Systems and Computing, Penn's central computing division, the School of Arts and Sciences evaluated Macintosh and DOS-based desktops and decided that NeXT represented the best environment for this strategic office. This presentation will review the planning and implementation process, as well as provide a live demonstration of this ground-breaking software environment.

Introduction

The University of Pennsylvania (Penn) is a large private research University located in Philadelphia, Pennsylvania. The University consists of 12 schools (enrolling over 22,000 students), 5 resource centers, and a number of administrative centers. The University employs approximately 17,000 faculty, administrative staff and other workers, and is the largest private employer in Philadelphia. Its annual operating budget exceeds $1.5 billion.

Computing at Penn is decentralized due in part to the technological trends as well as Penn's responsibility center approach to budgeting. Both the central administration and the schools provide technology services to their clients. Centrally, Information Systems and Computing (ISC) provides enterprise-wide leadership and services to the University community. Operationally, ISC is responsible for maintaining critical services such as the network backbone, enterprise wide transactional systems such as payroll, and the library's electronic card catalog. Initiatives for improving research, instruction, and administration both "bubble up" from the schools and "bubble down" from the ISC. The formal and informal initiative process often results in vendor relationships such as site licensing, conferences and product show-casing.

At the school level, the mission of Arts and Science Computing is to promote the use of information technologies to help the School achieve its educational and research goals. The School of Arts and Sciences (SAS) is the largest school at Penn. It has 28 academic departments several academic programs, over 700 faculty members, and more than 10,000 undergraduate, graduate, and continuing education students.

Under the direction of the Associate Dean for Academic Computing and the Associate Dean for Administration, SAS Computing provides centralized academic and administrative support for the school. This organization supports faculty, staff and students in the areas of research, instruction, and administrative computing. Because of the size of the School, SAS Computing mirrors many of the central computing services. One of the computing services within the School is provided by Technology Integration Services (TIS). The function of this organization is to provide the School with project management, office automation and business re-engineering functions that take advantage of changes in technology.

Penn has a commitment to Total Quality Management. This systematic approach seeks to achieve the highest level of quality and competitiveness through the ongoing improvement of services. Business re-engineering employs a similar methodology but services different functions. As defined by James Martin, business re-engineering is "the fundamental analysis and radical redesign of the business processes, jobs, structure and control to achieve dramatic performance improvement in cost, quality, service and speed."[1] This methodology provides a vehicle to restructure what we do and evaluate what information we keep. The benefits are improved customer satisfaction, improved efficiency, and higher quality work.

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[1] James Martin & Co., *Business Re-engineering Overview: Student Guide* (July, 1992), p. 2-8.

The Problem Defined

Earlier in the year, the Office of Technology Integration Service was asked to assist the Dean's Office in determining its technology needs and improving work flow and communication in the office. The personnel in the office consist of the dean, three associate deans, an executive assistant, an office manager, and five secretaries. All the support staff and several of the administrators had computers on their desktops at the time of the review. These were IBM-compatible machines that were asynchronously connected to PennNet, the campus network, but did not participate in a work group network. The asynchronous connections provided them access to University and School services such as Student Records, Library and host-based electronic mail.

One of the first tasks TIS undertook was a client assessment. This evaluation assessed the clients' needs, their use of technology, and the level of comfort they had with their current computing environment. The following areas were determined to be the most troublesome: inter-office communications; document sharing; paper mail processing; calendaring and event scheduling; and document retrieval.

The next task was to ascertain what were the most important tools required to perform their jobs. In addition to the basic tools like word processing and spreadsheet, it was determined that the office would benefit most from group software that would allow them to exchange and share information in a quick and easy fashion. It was found that their work flow could best be improved by finding appropriate products for electronic mail, electronic calendaring, and database management systems. Additionally, it was determined that significant advances in the ability to retrieve information could be made through the use of document imaging technology. This would also provide them with a vehicle to track work that both came into and flowed out of the office.

The general underlining requirement for all of these products was that they had to be easy to use and easily be integrated with one another. Any knowledge that could be transfered from the use of one product to another would be an added and welcome benefit. The introduction of a GUI (Graphical User Interface) environment was encouraged because it would make the technology easier to learn and use

Organizationally, the support staff reported to the Office Manager and she was responsible for the delegation and review of all work assignments. The reason for central work distribution was to enable the office to track the progress of work. Since the support staff worked as a pool, assignments were often initiated by one individual, reviewed by a second, and finalized by a third. As part of the work flow analysis, it was essential to determine how the work was currently handled. This step by step flow of the work allowed the client to inspect the number of participants in the process, to determine the number of workers necessary to complete a task, and to make recommendations on how to change and properly automate the work.

We chose the NeXTstation and NeXTstep as the solution for the Dean's Office. These are some of the specific challenges we faced:

Inter-office communications: Because of the demanding schedules of the dean and the associate deans it was often difficult for them to discuss problems and share information. They were looking for an easy and reliable way to communicate with a minimum of meetings and scheduled appointments. At the time of the review, two of the associate deans and a few of the support staff were using electronic mail while the others either had not been introduced to the technology or had been frightened away due to the complexity or unfriendliness of prior systems. The basic requirements for electronic mail were, therefore, that it had to be easy to use, allow for printing of documents, and be accessible from home as well as from the office.

Network services: Since the office did not participate in a work group network, network services were not being utilized. All typing was saved on diskettes and most were purged after two months. This prohibited the sharing of text from one document to the next and resulted in substantially more typing.

Calendaring: The dean and associate deans each had a secretary assigned to maintain their calendar. Calendars were maintained in appointment books. Each individual secretary was responsible for arranging and canceling appointments and making copies of the weekly and daily calendar for their assigned dean. The time needed for this task ranged from a few hours a week to a full-time responsibility and did not provide the deans with the flexibility they desired.

Paper Mail Processing: Approximately 70 pieces of mail were delivered to the Dean's Office each day. This mail was date stamped, logged in a notebook, placed in a folder, and then sent to the office manager who sorted and read all the mail before placing it in an appropriate folder. The mail was then forwarded to the Executive Assistant for review who made any necessary changes to the routing and work assignments before giving it to the Dean. After the Dean completed her review, the mail was returned to the Office Manager for distribution and re-logging via the Executive Assistant. A minimum of four people were involved in the processing of mail before action was taken and the process took up to one and one-half days for a given item.

Looking for a Solution

Three different operating system environments were considered for deployment in the Dean's Office: Microsoft Windows (version 3.1) running on an Intel microprocessor; Apple's MacOS Operating System (version 7.0.1) running on a Motorola-based Macintosh; and NeXT's NeXTstep operating system (version 2.2) running on a Motorola-based NeXTstation. While all three of these systems presented graphical user interfaces to the user, they were strikingly different in quite a number of ways.

A careful comparison of a standard set of attributes was done. These attributes included issues of system functionality, "friendliness" to the user, server attributes in a work group environment, networking functionality, system administration, and cost. The following discussion highlights the major factors that were examined and compared between these platforms and forms the basis of the decision that was reached to deploy NeXTstations for this office.

		MS-Windows PC	Apple Macintosh	NeXT
Typical Applications	Word Processing	Better	Better	Good
	Electronic Mail Interface	Better	Better	Best
	Spreadsheet	Good	Good	Best
	Work Group Database	Better	Better	Good
	Desktop Publishing/Compound Documents	Good	Better	Better
	Group Calendar Management	Better	Better	Good
	Document Imaging	Good	Good	Good
	Multimedia	Good	Good	Good

Figure 1: Comparison of Typical Applications

The first comparison focused on typical end-user office productivity applications. All three platforms clearly performed the basic office functions well (word processing, electronic mail, spreadsheet, database). NeXT, however, offered a clearly superior set of applications in electronic mail and spreadsheet. NeXTmail is the best of its kind in multimedia mail, with drag and drop enclosures, sound editing, and easy to use menus and filing. Lotus Improv, only now in beta test under MS-Windows, offers the state of the art in financial modeling with its multi-dimensional, fluid approach. For more conventional "rows and columns" users, Wingz and Mesa (a NeXTstep-only product with Lotus 1-2-3 macro support) are also available.

In some of the more advanced categories, MS-Windows began to wane. Desktop publishing/compound document creation has been in the Macintosh domain for several years now, despite the recent multimedia push under MS-Windows. NeXT has tried to maintain parity with Macintosh with its port of FrameMaker, the standard Unix workstation page layout product, and with new products like Pages and Create!. In some categories, Macintosh and MS-Windows showed their market leadership with more variety and more mature products than NeXT (database, group calendar). Document imaging and multimedia were not major focuses in the initial selection process, but were included as items of consideration. In the absence of more thorough analysis, it is sufficient to say that all three platforms are both imaging and multimedia enabled.

			MS-Windows PC	Apple Macintosh	NeXT
Networking	Internetworking	Remote host access	Good	Better	Best
		Access to data and services	Poor	Better	Best
	Access from Remote Locations		Poor	Good	Good

Figure 2: Comparison of Networking Attributes

The second set of attributes concerned networking functionality. The focus of this part of the analysis was on evaluating each workstation as a "window to the world," particularly the Internet. Additionally, it was important to see how easily this "window" could be "opened" from a remote (typically off-campus) location. Since the standard protocol of the Internet is TCP/IP, this section examined how the various workstations could function using TCP/IP protocol and products. The functions were divided into two groups: remote host access (using implementations of things like telnet and tn3270 emulation products); and access to Internet-based data and services (like Gopher, WAIS, other specialized data sources).

All three platforms performed remote terminal emulation, usually through the help of third-party software applications that are either available as free-ware or as commercial products. The NeXT stood out, however, in having both VT100 and 3270 emulation software built in, since the standard TCP/IP tools are part of the bundled implementation of Unix. Commercial products are also available where greater functionality is required.

In terms of access to specialized data services on the Internet, more differences appeared. Due to the lack of a "standard" TCP/IP implementation for DOS-based machines, what Internet client software that does exist for MS-Windows relies upon a variety of TCP/IP products, often requiring a reboot of the machine between using different products. Additionally, configuring an MS-Windows machine for network access is still very much an individual machine effort. Macintosh applications are almost uniformly written to run on top of MacTCP, Apple's implementation of TCP/IP that has been made available cheaply to colleges and universities in particular for several years. This has led to the creation of a number of good Internet clients that run uniformly on most Macintoshes. The NeXT ships with TCP/IP built in, so a standard has been set for which applications can be developed. Given the nature of the NeXT's true multitasking, and its implementation of a Graphical User Interface, the client applications written for the NeXT in this area tend to be well constructed, feature rich, and easy to use, even more so that their Macintosh counterparts.

Access from remote locations is primarily a requirement for those who want to work from home. In an ever-increasingly network-dependent world, this is usually summed up by users is one sentence, "I want to be able to do everything I do at work from home the same way I do it at work." For MS-Windows, there are no real choices to allow robust access to campus-based services from home. For Macintosh, two solutions exist, one based on Macintosh network protocols and one based on TCP/IP. The NeXT has the TCP/IP option only. Either way, the Macintosh and NeXT provided appropriate remote access functionality.

			MS-Windows PC	Apple Macintosh	NeXT
Server Functions	File Sharing	Server-based	**Good**	**Good**	**Good**
		Peer-to-peer	**Developing**	**Better**	**Good**
	Printer Sharing	Server-based	**Good**	**Better**	**Better**
		Peer-to-peer	**Developing**	**Better**	**Better**
	Networked FAX Gateway		**Good**	**Developing**	**Best**

Figure 3: Comparison of Server Functionality

The third set of attributes is server functionality. This is divided up into three functions: file sharing, printer sharing, and shared, networked FAX gateway. Additionally, printer and file sharing are divided into two possible styles of implementation: server-based, where there is a central server that delivers the service to all the desktops; and peer-to-peer, where individual user workstations provide access to their own local disks and printers, and gain access to the local disks and printers of other workstations. The server technology for MS-Windows is presumed to be Novell NetWare; for Macintosh it is presumed to be AppleShare; for NeXT it is presumed to be the standard Unix NFS and LPR.

All three platforms can deliver reasonable good server-based file sharing. Performance differs to a degree between the three, but they are all reasonable implementations. Macintosh and NeXT far surpass MS-Windows in peer-to-peer networking available, which is especially critical for smaller or simpler installations. Windows for Workgroups hopes to narrow this gap, but it is too soon to tell. Macintosh has always come with AppleTalk built-in, and System 7 has extended the capability of any Macintosh to "publish" all or part of its disk to any other Macintosh (or NeXT) user with password protection. Printer sharing with Macintosh is even easier. NeXT relies on standard disk-sharing NFS and printer-sharing LPR, and has some management tools to make setup easy. This same set of protocols enables either server-based or peer-to-peer networking, and the NeXT has the added functionality of not only being a universal server to all these platforms (i.e. both Macintoshes and PC's can be NFS or LPR clients), but comes with NetWare and AppleShare clients built into NeXTstep.

Currently, MS-Windows and NeXTstep support shared FAX gateways. This allows a network of users on different workstations to share a single (or multiple) FAX's for sending and receiving. Shared network FAX gateways for Macintosh are just now coming to market.

		MS-Windows PC	Apple Macintosh	NeXT
General Attributes	Ease of Use of Typical Application	**Good**	**Better**	**Better**
	Application Integration	**Good**	**Good**	**Best**
	Cross-Platform Interoperability	**Poor**	**Better**	**Best**
	"Mainstream" Product	**Yes**	**Yes**	**No**
	Vendor-Independent Hardware	**Yes**	**No**	**Not for long**
	Vendor-Independent System Software	**No**	**No**	**Somewhat**

Figure 4: Comparison of General Attributes

The fourth set of attributes is a set of general attributes. These factors usually weigh in to a decision once a system meets the basic functional requirements. The MS-Windows PC does adequately when it comes to ease of use and application integration across the windowing environment, and the Macintosh a little better, but the NeXT surges forward in application integration (including the inter-application messaging that MS-Windows and System 7 are promising for the future). Macintoshes have for some time been carrying the burden of DOS-MacOS interoperability (through DOS diskette utilities, and products like SoftPC), but the

NeXT goes one step further by providing both Macintosh and DOS hard disk/diskette support, as well as NetWare and AppleShare file support across the network.

Probably the biggest problem NeXT has is that it is not perceived to be a "mainstream" product, largely due to market share. Like the Macintosh, the NeXT's software environment runs on proprietary hardware (though an Intel 486-based version of NeXTstep is in beta right now!). Being hardware dependent on a single vendor is even worse when one is also software dependent (Macintosh). MS-Windows will run on many vendors' hardware. NeXTstep, on the other hand, has a relatively standard version of Unix (BSD 4.3) at its core, making it much like other Unix systems.

		MS-Windows PC	Apple Macintosh	NeXT
Set-up and Administration	Stable and Reliable Software Environment	**No**	**Yes**	**Yes**
	Easy to Configure	**Hard**	**Easiest**	**Easy**
	Easy to Network	**Hard**	**Easy**	**Easy**
	Easy to Learn	**Harder**	**Easiest**	**Easy**
	Easy to Support	**Hard**	**Easiest**	**Easy**
	Easy to Administer	**Hard**	**Easiest**	**Easy**
	Ability of End-user to Control Desktop Resources	**n/a**	**Yes**	**Moderately**

Figure 5: Comparison of Set-up and Administration

The next set of attributes, set-up and administration, is even more striking. It becomes clear here that MS-Windows is hard to install, run, and maintain. It is relatively unstable compared to Macintosh and NeXT, and requires substantially more support effort (and therefore cost). Macintosh was by far the easiest, but the real question is whether the additional effort and learning to support a cluster of NeXT's is justified by the additional functionality one receives. Finally, while an MS-Windows user is unable to provide, let alone control the use of local resources by others (again, leaving Windows for Workgroups aside), Macintosh users do this with ease (perhaps too much ease for security's sake) and NeXT users do this easily, but often with system manager intervention.

			MS-Windows PC	Apple Macintosh	NeXT
Costs	Hardware	Total	$3,970	$4,483	$4,547
	Software	Total	$334	$310	$564
	Total		**$4,304**	**$4,793**	**$5,111**

Figure 6: Cost Comparison

The differences in cost for these systems was not as substantial as one might have guessed. The MS-Windows system priced here consists of a PC-clone based on a 50MHz Intel 80486DX processor, 16MB RAM, 170MB disk, and 21" high resolution monochrome monitor. The Macintosh is a IIvx with a 32MHz Motorola 68030 processor, 16MB RAM, 230MB disk, 21" high resolution monochrome monitor. The NeXTstation Turbo is based on a 33MHz Motorola 68040 processor, 16MB RAM, 250MB disk, 17" MegaPixel monochrome monitor. The intent here is to select a reasonable configuration for each environment. Some might argue that Macintosh Quadra is a better comparison for the other two systems; this would significantly raise the price for the Macintosh configuration. The software cost is for a typical set of applications as described in the requirements and comparisons above.

Platform Selection

After careful analysis, the NeXT was chosen for installation in the Dean's Office. Its strengths in multimedia mail and spreadsheet applications, as well as networking and application integration, made it the best choice for an office that values ease of use above all else. Cost was certainly a factor, but it was felt that performance and functionality differences still made the NeXT a better buy over the Macintosh, the other leading contender.

Implementation

The introduction of a multimedia electronic mail system provided the client with the basic needs plus much more. All of the staff have taken extremely well to electronic mail as a primary method of communication within the office. Telephone messages can be recorded through a mail message instead of on pink slips allowing each person access to all their communications though a single interface either in the office or away. Internal office meetings have been reduced by more than half and the timely dissemination of information has increased significantly. This use of technology has changed the way the office communicates.

Through the use of an office file server, documents are now stored online and are easily accessible by members of the office. In the spring a shared fax gateway will be installed which will allow all users to send a fax directly from word processing without having to make a printed copy. This convenience will save time and reduce costs. Software is also provided on the server, making it very easy to update to new versions with only a single physical installation required.

Through streamlining the incoming mail process, and utilizing database and imaging technologies, we anticipate reducing the number of individuals involved in the handling of incoming mail by half and reducing the time to perform this task by two thirds. To date, the database technology has been implemented to automate the log in process and to provide easy tracking. Imaging technology will be implemented in the spring to allow mailing of copies to interested parties and reduce the time and cost of copying and paper distribution.

Through online work group calendars several people have access to calendar simultaneously, including the deans. Appointments can be made and changed in one location. The application also provides an easy method of printing schedules, if necessary.

With the introduction of the change in technology the single most difficult factor that needed to be addressed was the resistance many people had to changing the manner in which they perform their work. It was clear, however, that in order to take full advantage of the new technology it was essential to make this change. Using the NeXT, we have customized the desktop of the office members to make it easier, more efficient and more appealing for them to work.

Because of the GUI environment and the common structure of applications, we were able to complete initial training within a short period of time. Three ninety minute hands-on training sessions were held over the first week. These included basic computing, electronic mail, word processing, database management, and network basics. Within two days of the conversion to NeXT's and only the basic applications being utilized, work was flowing in and out of the Dean's Office well and the office was adapting to the new way of business.

Conclusion

This has been a true success story because people are using the new technology to improve the way they do their work. The changes in the technology have allowed for the opportunity to review the work flow, to make significant improvements, and thereby increase the quality of the work of the Dean's Office. Over the next few months several new applications will be introduced to the office including imaging technology. These changes will allow us to make better use of our staff and their time and improve our ongoing commitment to better service.

Reference

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Experiences Implementing a Decision Support System (DSS) Within a Management Plan

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In 1987, Stanford University School of Medicine, facing a period of rapid growth and increased complexity in the business of academic medicine, begun implementing a strategic plan for management of the School that called for decentralizing programmatic decisions and responsibilities to the academic departments of the School. The School management realized that enhancing the competency, skills and motivation of department business managers would be essential to the success of the plan, and, in addition, a sophisticated decision support system world be a necessary tool in the managers' arsenal. After a brief introduction to the plan, the paper discusses three major aspects of the implementation of the decision support system: technical implementation, data quality issues, and integration of the technology into the workplace. Finally, it lays out current and future directions as influenced by the successes and failures of the projects.

In the mid 1980's, Stanford University School of Medicine found itself facing a decade of rapid growth and change. The planned growth in facilities would take the school from 600K sq. ft. to 1000K sq. ft. New academic programs were planned in molecular and genetic medicine, and the School was revitalizing its clinical programs. The nature of clinical practice was changing due to increased market pressure from health maintenance organizations and changes in government medical insurance. Competition for federal research dollars was increasing rapidly. Under the pressure of these forces, the management of the School realized it could not manage this magnitude of change centrally so it embarked on a strategy of decentralizing authority and control to departments within the School.

Within the administration, the role of the academic department business manager was key to accomplishing this decentralization, so the School embarked on a program to bolster the skills and abilities of the business managers. This program had four elements:

- Find and retain the best business managers
- Develop their management skills
- Reward their accomplishments
- Provide them the information tools necessary to their success.

This led us in 1987 to invest in the development of a decision support system.

Selecting a System

Working with a committee of business managers, school administrators, and University advisors, we developed a set of criteria for the decision support system.

- An industry standard relational database with SQL
- A GUI workstation with an integrated analytical toolset, including query, spreadsheet, text, statistics, and plot
- Potential for user developed models
- Easy method for sharing models
- Fits our strategic architecture (Ethernet, TCP/IP, open, client/server)

We spent nearly a year developing an RFP, evaluating vendors, including bench testing a couple of products. We eventually selected the Metaphor Data Interpretation System[0] (DIS) from Metaphor Computer Systems, Inc. The Metaphor DIS was later licensed by IBM.

Our system now contains the following components:

- A Sybase RDBMS running on a SUN 4/470 with 2GB Disk
- Ethernet with XNS LAN and TCP/IP WAN
- Metaphor/Sybase Gateway running on an IBM RS6000
- Three IBM PS/2 Model 80 fileservers
- 20 active IBM PS/2 workstations running Metaphor

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[0] See Patricia B. Seybold, "Metaphor Computer Systems: A Quiet Revolution," Patricia Seybold's Office Computing Report, August 1988 for a description of the Metaphor Computer System.

Figure 1. below, shows the hardware configuration.

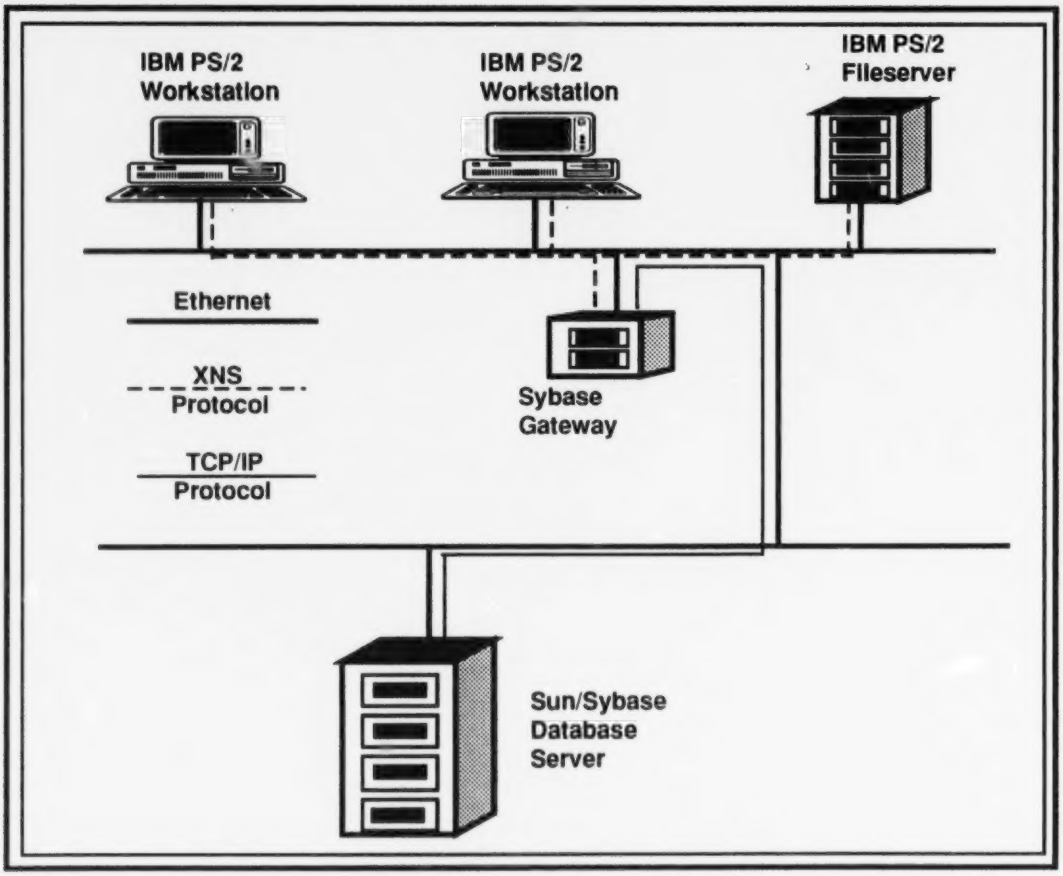
IBM PS/2
Workstation
IBM PS/2
Workstation
IBM PS/2
Fileserver
Ethernet
XNS
Protocol
TCP/IP
Protocol
Sybase
Gateway
Sun/Sybase
Database
Server

Figure 1. Current Hardware and Network Configuration

Data, Data, Data

Once we had installed the system, our first task was to fill the server with data. We viewed each faculty member as a "center of enterprise." This organizing principle for our database schema would allow us to precisely model the economics of the Medical School so that we could measure the impact of specific programmatic decisions.

We began the process of locating, understanding, cleaning-up, re-organizing, pre-aggregating, integrating, loading, and verifying data. This was not an easy task. Our data sources included the University IBM mainframe applications, a commercial clinical billing system, and two different hospital systems, one for Stanford University Hospital and one for Lucile Packard Children's Hospital at Stanford. Data quality issues were abundant and difficult to solve.

Our operational systems were not designed with decision support systems in mind. There was a lack of data integration across operational systems. For example, the payroll system required a percentage effort for each pay-line, but that information was not passed in a usable way to the accounting system so it was difficult to associate salary dollars with effort. Our central systems had been developed by vertical lines of business and there was no overarching view of the information as a whole. A large part of our task was to integrate this data outside the application.

We eventually developed a "Metalink" table containing all the identifiers for a faculty member. This included the social security number, employee ID, doctor numbers in the Faculty Practice, and the two hospitals, California medical license number, PI number for research, and space identifier. This table is the hub that ties together information from disparate systems.

Figure 2. below illustrates the difference in the way data is viewed for decision support vs. operations. Each central office is responsible for a vertical slice of the data and tends not to take responsibility outside its domain. Data needs for decision support cut across the operational organizations as indicated by the X's in the vertical domains.

	Central Office Vertical Organizations						
Decision Support View of Data	**Human Resources**	**Finance**	**Sponsored Research**	**Facilities**	**Faculty Practice**	**Student Resources**	**Development**
Faculty Retirement →	X	X	X	X	X	X	X
Research Productivity →	X	X	X	X	X	X	
Faculty Profile →	X	X	X	X	X	X	X
Facilities Planning →	X	X	X	X	X	X	X
Faculty Teaching Load →	X		X		X	X	
Five Year Forecast →	X	X	X	X	X	X	X
Grad Student Support →		X	X			X	

Figure 2. Decision Support vs. Operational View of Data

Key identifiers were missing from the operational systems, that is, some of the important data did not have faculty identifiers. The University space inventory could attribute space to a department but not to faculty member. We had to modify the system so the School could maintain space data by faculty. Our financial systems did not attribute funds or expense accounts to faculty. We are approaching this problem by establishing separate attribute tables that allow us to associate values, like faculty identifier, with base tables.

There was a lack of clarity and consistency in the definition and usage of data in the operational systems. Seemingly simple questions such as "who are all the faculty?" became devilish as you had to consider all the different types of academic staff who might be acting in a faculty role as well as the purpose for which the question was asked. A department asking that question might include visiting faculty, voluntary clinical faculty, and instructors while the faculty affairs office might exclude all but tenured faculty.

We found numerous instances where data and codes that had originally been intended for one purpose, fell into disuse or were used for one purpose in one organization and another purpose in another organization.

Finally, data and data definitions changed over time. This was caused not only by changes in operational systems, but also by changes in organization and changes in usage of data. For example, when we started the project,we had 13 clinical departments and six basic science departments. We have added three new basic science departments, Radiology split into two departments, Surgery split into three departments and its Thoracic Surgery division combined with Cardiovascular Surgery to become Cardiothoracic Surgery. We now have nine basic science 16 clinical departments.

All of these problems took a great deal of effort to resolve and continue to require much attention in our periodic download of data. Each month we must perform referential integrity checks against all the data we are downloading. Our DBA spends about 40% of his time dealing with routine downloading of data.

Formulating the data requirements was another major problem we encountered in building our database. While we had a good organizing principle for the schema, we were less clear on the specific meaning and usage of the underlying data.

We found that high-level planners sometimes would make gross assumptions about the data that would lead to erroneous conclusions. For example, they wanted to measure a faculty member's "hit rate" for sponsored research, that is, the ratio of proposals to awards. On the surface this sounds simple because we do track proposals and awards by faculty. However, if you look at the data it becomes very misleading. Program project grants may have many investigators participating in the project but only one is the principle investigator and, under our operational system, that person would be credited with the full amount of the award. Proposals may go through several iterations so that what started as a million dollar proposal ends up as a proposal for half that amount and is awarded at less than that. Which number is your measure?

We also had difficulty with the scale-ability of analyses, that is, an analysis that is useful at the School level might break down if carried to the department or faculty level. A good example of this was an analysis of the ratio of research expenditures to research space. At the school level, this would yield useful information for facilities planning. At the department level, this would begin to break down because cross-department projects would attribute space and research expenses to different departments. At the faculty member level, the information was almost useless because of the lack of integrity of the faculty level data.

We even had difficulty formulating useful questions. In the example above of measuring faculty hit rates for sponsored research, we finally decided that even if we could formulate a meaningful answer to the question, the question itself was not useful. It was neither a good measure of productivity nor did it yield a good predictor of future award volume. We dropped the question and continue to struggle to find meaningful predictors and measures in this area. As the planners gained experience with the data and analyses, this became less of a problem.

Departmental business analysts, on the other hand, understood the operational data well, but they wanted the decision support system deal with operational issues rather than planning and analysis. This kept driving us to capture more and more detail information rather than putting our emphasis on higher level aggregations to support planning.

Integration of Decision Support into the Workplace

Our approach to implementation was to establish a project team led by the Planning Office and with membership from the Information Systems Group and four academic departments. Other offices, such as Finance or the Faculty Practice Program (FPP) would be called on as needed. We were to build the system on a subject area basis, starting with facilities and moving through FPP, finance, faculty appointments and so on. For each area, we would specify, design and implement the appropriate relational tables and associated applications. The planners and departmental analysts would use the applications for generic reporting and would generate ad hoc analyses to solve particular problems, and, based on usage, we would iterate on the database schema.

Our rationale for this approach was that we needed the experiences of both School and department analysts to be able understand the proper schema for the database and the appropriate applications. We felt that just as the School had a different view of data than the central University, the departments would have a different view than the School. What we hoped for was a simultaneous top-down and bottom-up development.

The first problem we ran into was that the departments had a much different view of the data than the School. Although we anticipated this, we did not fully understand the magnitude of the difference. The project was christened "Management, Analysis and Planning System" (MAPS) and we felt our charter was to broadly support the planning functions in the School and departments. But the departments focused on operational analysis; they were so busy fighting day-to-day battles they had no time for planning. They wanted information at the detail transaction level while we were interested in building aggregations for higher-level planning and analysis. If the system could not help with the daily problems that they faced, they were not interested in participating in the project.

This exacerbated our second problem; learning and retaining the software tools and databases. While most of the software tools were reasonably familiar, it required extensive training to learn how to use the tools as an integrated package so that you could build models, and one needed to use the tools frequently to retain that knowledge. Additionally, the data was extremely complex and, even though we had a visual SQL query tool, it required a high level of expertise to successfully create a query. The departments never got to the point where they could create their own queries, much less build models. In fact, only a few users in the central School offices developed any expertise; most of the models were constructed by the analysts in the Planning Office.

We were also plagued by turnover. In the four years of the project, we had four different project managers and extensive periods with no project manager. Every user that we trained either left the School or changed departments. Eventually, we pulled back and developed the system from a School perspective, leaving the department view for later.

We were successful in building many applications for the School and in performing several important ad hoc analyses. We currently use the system for our quarterly financial report, our annual "fact book," a funds analysis report, a faculty salary tracking report, chairman search packages, and several other important applications. We have performed many ad hoc analyses including the impact of an early retirement plan for the faculty, FTE levels in the School, graduate student stipends, and many others.

Current and Future Directions

While we have not yet cracked the problem of supporting the departments, we have learned from our experiences and this has helped shape our plans for the future. We specifically learned the following:

- Planning is an infrequent activity; for departments to be proficient planning tools and data must be integrated into their daily operations.
- Having tools and data is not sufficient to get departments to do planning, they must have time and impetus to plan.

- The pump must be primed with fully implemented planning applications so that planning can be started without the need for every department to engage in the intellectual exercise of developing a planning methodology.

Armed with these insights, we have started several projects that we hope will help us reach our goal of having each department able to develop and follow comprehensive plans for the future.

The first project is to continue to move DSS out to departments, but at a slower pace and with individual mentoring of each department analyst. As we work with the analyst we will focus on current problems in the department. If we require additional data we will develop means of capturing that data through local entry in the department or extraction from central systems.

The second project is to develop a Grants Management system. This system will use the data that has already been downloaded from the University systems, including purchase requisitions, expenditures, sponsored projects and personnel along with local data about commitments. The local data will be entered by the department using a Windows or Macintosh client application and stored on our Sybase database server. Reporting will be done through Metaphor giving the departments a flexible set of standard reports and the ability to create their own reports using the DSS tools.

This project will address two of the problems we found. First, it should free up time for the business managers as they are currently spending considerable effort in manually managing their grants. Second, it should get them familiar with using Metaphor on a daily basis.

Our third project is to develop a Department Resource Planning Model in Metaphor. This model is based on a series of Faculty Profiles; one for each faculty member in each department. The Faculty Profile is a multi-page spreadsheet containing three years of history and five years of projection on a faculty member's activities. The historical data is from our database and covers compensation, operating budget support, FPP income and activities, sponsored research income and activities, space usage and other funding. The business managers manipulate a set of decision variables to project the future financial and other resource usage for the faculty member. The spreadsheets are loaded into a database and summed over a department to give a projection of the total activity for that department.

This application will not only help the business managers to plan, it will also teach them about the relations between various components of a faculty member's activities.

Conclusions

There are three important conclusions that we have drawn from our experiences in implementing a DSS:

- Decision Support Systems require that data and processes be viewed from a corporate rather than line organization perspective. This perspective will require integration, consistency, and accuracy of data across all lines of business.
- The cultural changes required to implement a DSS are significant and take time to overcome. It takes years of exposure to a technology like DSS for it to work its way into the culture of an organization.
- A strong business need for decision support and a strategic business plan are essential to the success of implementing a DSS. Without these, you won't know where you are going and will not have the means to steer.

Administrative Workstation Project at Indiana University

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ABSTRACT: Administrative Workstation Project at Indiana University

Efforts to sell the information technology vision are plagued by the fact that network infrastructure initiatives require huge investments from the campus during a financially-bleak decade. However, this needn't always be the case. The confluence of budget woes and an information explosion created a unique opportunity for Indiana University to sell the information technology vision in 1990. A generous grant from the Apple Corporation enabled us to place Macintoshes and a suite of software on the desks of key campus administrators, and undertake an ambitious project of technological integration into administrative life. The project, dubbed "Administrative Workstation Project", increased knowledge and use of the information technology by key administrators, resulting in greater creativity and productivity in the management function, and improved attitudes toward information technology.

Overview

During the 1980s Indiana University experienced an information explosion similar to that experienced at other colleges and universities. Coupled with this situation was the physical growth of Indiana University's eight campuses, and the increasing importance of university-wide administrative functions that were more cost-efficient. Together these factors spawned an awareness of the need to apply technology to administrative intracampus and intercampus office coordination and administrative functions.

In Spring of 1990, Indiana University administrators in the Finance and Administration division chose to undertake an all-encompassing project, integrating technology into the daily routine of their administrative offices. Earlier piecemeal efforts to integrate technology had resulted in diverse and often incompatible computing platforms within the offices reporting directly to the Vice President for Finance and Administration. Consequently, these offices were characterized by a wide-range of both technical sophistication (from technologically-sophisticated to two-finger typists who described themselves as computer phobics), and commitment to information technology as a viable solution to executive office management.

Indiana University's University Computing Services and Management Advisory Services divisions were charged with developing a project, labeled the "Administrative Workstation Project." The goals for the project included enhancing the computing environment for university executives, increasing knowledge and use of the technology by these executives, increasing creativity and productivity in the university administration function, and improving executive attitudes toward technology. In recognition of the potential costliness of this project, hardware vendors were asked to submit proposals and cost evaluations. Three were obtained by July.

The project team met for the first time in early August. The core team included members of the educational, support, information services, and workstations staff of University Computing Services, but was purposely kept small for greater flexibility. It was agreed that the key to achieving the project goals was to sell the importance of information technology to the executives. In turn, by enhancing the computing environment in executive offices, and increasing these individuals' knowledge and use of technology, the status of information technology at Indiana University would increase. Functional roles were outlined for the team members and personnel resources estimates were calculated. The project team was instructed to solicit help from other staff members on an as-needed basis. Subsequently, a member of the network staff was added to the project team in recognition of the central role of network technology in the success of the project.

By the end of August, the technical and financial analyses of the proposals were complete; a functional analysis of the computing needs of the administrative offices in Finance and Administration was also prepared. Of the three responding vendors, Apple Corporation's proposal for the project was accepted. The Administrative Workstation Project proposal was reviewed by senior management of the computing center, and 29 executives and their assistants were selected as project participants. Roughly eleven months later, the formal project concluded on June 30, 1991. Judging from the participants' evaluations, the project has been quite successful. A number of executives who were once self-described computer-illiterates, now expressed enthusiasm about their Macintosh capabilities. Indicators like the aforementioned example suggest increased computer knowledge among the participants, the result of which was greater productivity and a more positive response to the information technology vision.

Strategy

In this section, we detail the key components (ease of use, incremental, specialized instruction, consistency, access, security, support) of the strategy used by the project team to achieve project goals and promote the importance of information technology.

Ease of Use: Given the action-oriented workstyle of the executives, any technology introduced into the office environment had to be easy to use. An intuitive interface, along with incremental, specialized instruction, was critical in meeting this requirement. "Ease of use" also dictated that ergonomic principles be employed in the design of the environment. Apple Macintoshes provided the intuitive interface.

Incremental, Specialized Instruction: Executives are unlikely to attend mass training activities for the general staff. What was needed instead was an exclusive training program with incremental, specialized instruction. An "Administrative Workstation Education Series" was developed by the University Computing Services Education Program staff, and throughout the late fall and spring, project participants attended a variety of weekly instructional sessions.

Consistency: Unlike Indiana University's computing center staff, the executives did not value or thrive on an ever-changing technology environment. Priorities and responsibilities in the executive environment are often in flux, and it is vital that support technology be reliable and consistent. The project team met the consistency requirement in four ways. First, the functionality that the participants had before the project began was equal to, or greater than, functionality they achieved afterwards. Second, consistency with University technology standards was maintained so as not to leave the Finance and Administration executives "stranded" on a hardware and software island. Third, consistency was maintained between the computing environment of the senior executives and that of their staff by including key administrative assistants in the project. Fourth, consistency was maintained between the DOS environments found in the majority of the participating administrative offices and the new Macintosh environment.

Access: Both administrators and their staff required access to the same data on a centralized resource. Consequently, the following steps were taken: an "Administrative Workstation Project" server was purchased as part of the project; a Local Area Network (LAN) administrator was identified from one of the participating offices; project participants received training on server technology, and by December the project participants created their monthly reports using server technology.

Security: One of the first concerns that executives in higher education have about a new technology is security. It was important to demonstrate to the participating executives that security could be maintained at existing levels, or even enhanced. The security requirement meant ensuring that the accounts and data of project participants would be protected, by limiting access to designated personnel. This requirement also necessitated that administrators and their assistants have the ability to recover from any possible system and data loss that might occur.

Support: Project participants needed access to qualified technicians during the transition period between the old technology environment and the new. As part of the grant, Apple Corporation provided funding for part-time support personnel to assist the 29 administrators during the typical 40-hour week. Every effort was made to hire support staff who were critical thinkers, who could verbalize technical problems at a level appropriate for a wide-range of users, who were aware of technological alternatives, and who would allow the project participants to make their own decisions. The requirement that the hourly staff respect the confidentiality requirements of these executive offices was also of primary importance.

Progress Toward Project Goals

The project was undertaken with five primary goals in mind: the enhancement of the administrative computing environment, the technological transformation of administrative office functions, an increase in administrative knowledge of and comfort with technology, an increase in the use of diverse applications, and the promotion of a distributed computing environment. Progress toward these goals was extremely good.

Enhanced Administrative Computing Environment: The project placed mid-range Macintosh computers with a suite of software on the desks of 29 executives and their assistants in the finance administration area. These Macs replaced an assortment of aging DOS microcomputers and terminals with unsupported software. The standard workstation selected was the Mac II ci with 8 MB RAM, an 80 MB hard drive, ethernet card and an Apple 13" monitor. Ethernet LANs were established in each office or series of offices with an EmPac 80486 Novell file server having 660 MB of hard disk and several LaserWriter INIT printers. Each workstation had access to the IBM administrative mainframe using TN3270 and the academic VAX Cluster using Telnet. Mac Powerbooks were furnished for home use, and Timbuktu Remote with NEC 9600 baud modems were used to dial-in to the mainframes and LAN services. Software provided was Aldus Persuasion, MacDraw II, Excel, WordPerfect, Access PC, FileMaker Pro and Address Book.

Technological Transformation of Administrative Functions: The project sought to create a positive technological environment by utilizing LAN-based technologies to transform the way that university business was conducted, and provide a stimulating environment in which to work. Participants were interviewed upon completion of the project to evaluate the success of this aspect.

Many reported that their style of interacting with one another had changed, and that this had resulted in greater efficiency. For example, one administrator commented that use of the technology re-distributed the typical workload of his office, and that by using the server in concert with his assistant, participation in many projects increased. The application of technology clearly had the effect of reducing barriers to work-related interactions, e.g., diminishing the importance of physical presence. As communication could occur regardless of separation by distance or time, productivity under these traditionally prohibitive circumstances was now unhindered.

One application cited as a significant timesaver was the electronic telephone log. Assistants receiving phone calls replaced a paper telephone log with an electronic one, which greatly simplified searching for earlier calls. Another administrator enjoyed being able to work from home during evenings and weekends with the same tools that were available in the office. In both cases, greater productivity was the result.

Participants also exhibited an increased sense of autonomy. Administrators learned that they could create their own memos while their thoughts were still fresh, then send the draft to their assistants in preparation for a final copy. Both administrators and their assistants became more independent computists, relying more on their individualized abilities and networking efforts with co-workers, rather than the University Computing Services Help Desk.

Both creativity and autonomy were greatly increased over the course of the project. One example cited repeatedly as a positive outcome was the ability to create material for papers and presentations using graphics. Other examples included the use of network services and an increased motivation to migrate from formerly non-standard software to strategic technologies. Prior to the implementation of the project, these technological innovations were little understood; as a result of the project, they became a way of life for those involved. There was, of course, some variance in opinion. A few participants commented on the richness of the Macintosh environment, but maintained a preference of the more familiar realm of Windows environments. In one case, server problems put a damper on use of the entire system for a one week period.

In all, the general orientation of project participants underwent what might best be described as a paradigm shift. This is well illustrated by the following executive's comment centering around the replacement of a Macintosh "desktop" for a physical desktop: "I arrive in the morning, set up my desktop with mail and applications, jump in and out of applications, and generally have shifted my focus from paper to the workstation."

Increased Knowledge of and Comfort with Technology: Without exception, project participants reported that they were more knowledgeable about computing and information technology as a result of the project. One administrator commented that he felt his office was on the cutting edge of administrative computing. In general, attitudes about computing moved from ones of trepidation or ignorance, to ones of increased confidence and comfort in using the computer to accomplish more and better work.

The associated Administrative Education Series was the primary vehicle for assisting the project participants with acquiring more knowledge about the technology, and was rated by the majority of participants as "outstanding", and as "satisfactory" by the remainder. Generally speaking, prior DOS users were impressed with the user-friendliness of the Macintosh. Many project participants felt that the educational series was key in enabling them to use a variety of technological applications more frequently, and with greater ease.

Use of More Diverse Applications: Another of our primary goals was an increase in the use of diverse applications by project participants.

Enhanced Distributing Information Environment: Overall, users who were operating in a Mainframe-Based, Terminal-Oriented Computing Environment were able to migrate to a more user-friendly Workstation-Based, Network-Oriented Computing Environment. Commitment to the technology post-project was evident by the hiring of LAN administrators by several of the participating departments.

Things We Would Do Differently

The vast majority of things that we would do differently fall under the heading of inclusion. In general, we would include as many individuals as possible to avoid any sense of exclusionary practices. We failed to recognize that the project would be perceived as a high-status project because it involved top executives in the university. As a result of this perception, more individuals sought to be included in the project than our personnel resources could handle. In retrospect, we should have begun the project by identifying any computing support staff from the departments participating in the project, and inviting them to join the project team. We should have also included computing center staff members who thought they were making a major contribution to the project. Finally, we should have included assistants to the assistants of executives, if available funds allowed for this.

Another area in need of improvement involved timing. First, we would spread out the installation time period. The hourly assistants worked 80-hour weeks during the installation period, as did many other members of the project team. In addition, we were forced to ask Communication Services to put our project ahead of others in order to get data jacks installed in a timely manner. Communication Services graciously agreed to assist, but we should not ask that of them twice. Second, we would change the timing of workshops. The workshops should be bi-weekly or monthly, but not weekly. It was our experience that project participants cannot assimilate the new tools and maintain their current workload if the workshops are scheduled too closely. Third, we would change the timing of the introduction of specialized functionality. Project team efforts were wasted on providing instruction on "bells and whistles" prematurely. The time to introduce bells and whistles is after basic functionality is achieved.

Another set of things we would do differently involves negotiations. Next time, we would negotiate with the project participants to be partners with the project team in the goal to make them more independent computists. This must become a shared goal. We would also negotiate with the participants about support issues for the year following the project BEFORE the project starts. This would allow administrative units sufficient time to budget for any additional personnel costs they might incur. We would also negotiate in advance as to what constitutes a "crisis." Team members and project participants had different definitions of a crisis. In the future, we would advise that if the project team and computing center will not be available 24 hours per day, seven days a week to handle support issues, to make that known in advance. Identify the hours when project team members are available and stick to these hours rather than give the false impression that support is available around the clock.

All projects have obstacles. If we had it to do over, we would identify our potential points of vulnerability from the onset, that is, we would attempt to predict the obstacles to project success. In retrospect, we recognize that the newest technology will be our greatest area of project vulnerability, regardless of the technology and regardless of the project. The newest technology introduced to the group was Local Area Network (LAN) technology.

There are many things we would do differently in the LAN area. We would identify a LAN administrator from the participating offices at the beginning of the project. Moreover, we would assign a project team member to help the administrator develop policies and let the LAN administrator enforce the policies from the beginning. We would then work with the LAN administrator to develop an organizational structure for the server prior to placing participants on the server. The server environment served ten different departments, all with different notions of a filing structure. Consequently, the server took on a structure analogous to allowing 29 library patrons to organize the shelving scheme of the public library. We would develop a LAN/server policy early on in the project. Political considerations dictated server policies in the early days of the project because a policy did not exist. Once the "de-facto" policy took shape, it was difficult to implement new regulations.

Still another area in need of revision is that of training. First, we would group the participants in the mandatory introductory classes, basing the grouping on past computing experience. An individual who is new to computing is very different from an individual who is new to a platform. We knew that, but we thought that keeping the group of executives together was more important than ability grouping. It is not. Second, if we had it to do over again we would provide classes in one dedicated, state-of-the-art training site. This would make it possible to have more stable training in a real classroom environment with much less effort on the part of the Education Program staff, as well as giving executives a better impression of our campus computer classroom environments. Third, we would plan differently for the training component. We would have the training coordinator meet with representative(s) from the participating offices to clarify their training preferences, to be sure the right questions are asked and right answers given for rationale behind the training.

Finally, there is the category of oversights. If we had it to do over we would include network factors in the platform decision. Given the campus goal for distributed computing, a platform cannot be evaluated outside the context of network issues such as file sharing, remote access, and the state of the deployment of the network. In future projects, the networks staff of the computing center should be involved in the original evaluation of vendor proposals. Further, we would resolve the workstation platform compatibility problem head-on and make this an objective for a project team member. Our executives did not work in isolation. As a result of the grant from Apple, many of our executives now had platforms that differed from the majority of their staff. We would provide training and/or documentation on the subject of successfully migrating from one platform to the other.

The Future Distributed Computing Environment (DCE) for Executives

Since the project formally ended, a new executive service environment has been conceptualized and developed. The Indiana University Distributed Computing Environment (DCE) is a service environment in which students, faculty and staff have transparent access to a full range of network-based services and information. Access to the DCE is provided by a variety of computers, through the single access point of a desktop computer featuring a graphical user interface. The client/server cooperative processing paradigm is utilized to deliver services directly to the workstation user.

The Distributed Computing Environment includes and integrates four network service domains:

1. **Personal:** The sharing of one's personal workstation resources with users at similar workstations.

2. **Workgroup:** Systematic group-level sharing of applications, data files, printers and other peripherals among the workstation users in a workgroup or department.

3. **Campus/University:** Systematic, ubiquitous access to University data, computing, communications, storage, application, and peripheral resources provided by University-wide agencies.

4. **Internet:** Evolving access to the world-wide information holdings of organizations on the Internet.

The DCE and the Administrative Workstation Project

As described in earlier sections of this paper, the project resulted in the establishment of a vigorous and widely used workgroup network service domain. All Macintoshes were equipped with Ethernet adapters. Utilizing EtherTalk technology (AppleTalk protocols over an Ethernet data link layer), data and applications were shared among project participants through a Novell server equipped with the NetWare for Macintosh NLM (NetWare Loadable Module, and add-on to basic NetWare). Standard AppleTalk printer sharing was supported, with Dayna EtherPrint devices connecting the shared LaserWriters to the Ethernet.

Project participants were also introduced to the personal network services supported by the 7.0 version of the Macintosh operating system such as File Sharing and program linking.

At the time of the project, access to the Campus/University service domain was obtained through traditional timesharing, not distributed computing. The Macintoshes were equipped with a telnet (the standard TCP/IP terminal emulation application) featuring both vt100 and 327x terminal emulation. Project participants accessed University information and messaging services through terminal sessions with University mainframes.

This project experience illustrates well the bi-modal nature of Indiana University computer service delivery in recent years. Personal and workgroup applications and services have evolved as local and native workstation services; campus-specific, university-wide, and remote applications and services have remained mainframe-based, with access typified primarily by terminal sessions, and secondarily by file transfer.

Indiana University has begun a deliberate effort to shift from this dual mode of computer service delivery to a single, unified mode through which central services are provided as network-based, client/server applications delivered transparently to, and fully integrated with, the desktop computing environment. The new client/server applications will be provided for DOS (initially), DOS/Windows, Unix/Motif, and Macintosh workstations.

The New Executive Service Environment

Generic messaging services will be workstation based. We have deployed workstation mail based on the POP (Post Office) and SMTP (Simple Mail Transfer) Protocols, and Usenet News readers based on the NNTP (Network News Transfer) Protocol. We have also begun a project for a distributed conferencing system.

Generic information access services will be workstation-based. We have transferred our Campus Wide Information System -- our campus' computer-mediated mechanism for the selection and delivery of information and services -- to the desktop environment. Based on a transitional protocol implemented over TCP/IP, the system, WISE (Workstation Information Service Environment), will evolve to a standard protocol (e.g., Z39.50) when a standard emerges.

Additionally, we have begun implementing a series of information applications based upon distributed relational database technologies. Typical applications in this category include the University Register, Events Calendar and Address Book. Our initial distributed database product is Ingres, used in conjunction with the Integrated Development Environment and PolyServer network data access products from the Uniface Corporation.

New administrative systems will also be workstation-based. Among them is a new Financial Information System. Within this application and others, the salient characteristic will become "work flow" rather than "transaction processing". Open, standards-based computing platforms with full TCP/IP connectivity are the targeted server systems for these applications. To support access to legacy data from the new applications, we have been evaluating technologies which provide access to IBM VSAM data from our distributed database client/server domain.

Finally, ad hoc query and reporting tools will be workstation-based. We are just completing a project that has identified Data Prism from Brio Technology as the standard desktop data access tool for the Macintosh. Q+E from Pioneer Software is the leading contender for DOS/Windows. An Ingres-DB2 gateway provides access to legacy data on the IBM/MVS mainframe from the desktop query environment.

A combination of specially-designated desktop data access tools that provides views of data and data access applications will provide a functionality commonly termed an "Executive Information System." Delivery is predicated on the basis of an ever-growing and increasingly powerful installed base of workstations, and deployment of a ubiquitous high-speed University network.

The implementation of the above is made possible by a prior implementation of network authentication services (Kerberos); directory services (Berkeley Name Domain Service and Hesiod; X.500 experimentation begun); time services (Network Time Protocol); standard compilers (ANSIC); standard Transport Layer Interface (Berkeley sockets); standard network protocols (TCP/IP); and standard user interface toolkits (Macintosh, Motif, C-Scape for DOS; Windows toolkit TBD).

Why is this our strategic direction?

The ability to access the information and services of a variety of computers is quickly becoming a necessity in higher education. Using the workstation as a service portal is the best way to provide services from a wide array of sources. Delivery is through a single, familiar local environment featuring Graphical User Interfaces (GUI) with point-and-click service selection, allowing for complete personal access to services regardless of the placement of services on the network, or the user's location.

The client/server model supports optimum utilization of network computing resources by identifying the computer best suited for a particular task, and processing within that station's specially-designed applications. Thus, the client workstation moves beyond the stage of terminal emulation to the maximum utilization of all capabilities. This is especially critical given the millions/tens-of-millions of dollars the typical institution has invested in desktop computers. All computing platforms, regardless of vendor origin, can and should be fully utilized and integrated.

TRACK VII

TEACHING AND LEARNING: WHERE AND HOW DOES IT FIT?

Coordinator: Larry D. Conrad

There is much discussion in higher education about the need to change our teaching and learning paradigms. Information technology can help provide the momentum for this change. Papers in this track focus on the role IT can play in facilitating pedagogical changes and in enhancing instructional delivery mechanisms.

The Vision Carolina Project:
A New Vision for Telecommunications in North Carolina

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The University of North Carolina at Charlotte is involved in a two year pilot project which links public schools, community colleges and universities through a fiber optics based telecommunications network called Vision Carolina. Through this distance learning project, regional partnerships have been formed and new educational opportunities are being developed.

Background

The Vision Carolina Network is a unique business-education partnership sponsored by Southern Bell and Northern Telecom which began in the fall of 1991. The Vision Carolina project is one of two interactive, distance learning, fiber optics projects sponsored by Southern Bell and Northern Telecom in the nation. The other project is located in Mississippi. It is known as Mississippi FiberNet 2000.

The Vision Carolina Network includes two separate networks in North Carolina, an eastern North Carolina project and a southern piedmont project. The New Hanover county network is located in eastern North Carolina. It links a total of five sites within the one county including two high schools, Cape Fear Community College, New Hanover Regional Medical Center and the University of North Carolina at Wilmington.

The Charlotte area network is located in the southern piedmont area of North Carolina and includes 11 sites. It spans three counties, Gaston, Lincoln and Mecklenburg and links seven high schools, Central Piedmont Community College and its North Area Learning Center, Gaston College and its technology center, The Lincoln School of Technology and UNC Charlotte. UNC Charlotte, Central Piedmont and Gaston College have been involved in distance learning for a number of years prior to the project.

The Charlotte area demonstration project is further enhanced by the larger interactive network called CONCERT which is an acronym for Communications for North Carolina Education, Research and Technology. The CONCERT network is a fully interactive point-to-point network which currently connects UNC Charlotte with seven other universities in North Carolina, four medical schools, the Center for Microelectronics located in the Research Triangle Park area of North Carolina and the Center for Supercomputing. Through this extended linkage to other network systems, the Vision Carolina network is in actuality an interwoven network.

The partners of the Vision Carolina demonstration project in the Charlotte area have access through the CONCERT network at UNC Charlotte to resources and programming across the state. While CONCERT is a completely separate interactive network from the Vision Carolina network system, it represents an important gateway to extended opportunities and programming.

During the two year pilot period, Southern Bell and Northern Telecom have provided full-motion interactive video equipment in the studio classrooms at each site of the Vision Carolina project and underwritten related operational and maintenance costs. At the end of the pilot period, the partners of the project will have the opportunity to purchase or lease the equipment and lease the fiber optics transmission services. While this project is nearly a $4 million project, the business partners are attempting to make distance learning technology an affordable resource for educational institutions. Pricing information is expected to be released by the business partners of the project by February, 1993.

Project Partnership

The Vision Carolina project is a result of the combined planning efforts of education and business. The educational partners of the project include the participating high schools, community colleges and the two universities of UNC Charlotte and UNC Wilmington.

The network is provided by the business partners of Southern Bell and Northern Telecom. VSI, Videoconferencing Systems Incorporated is also a business partner contracted to install and maintain video equipment. Each company has had a significant and important role in the overall success of the project.

The sites selected to participate in the Vision Carolina project are committed to the goals of utilizing the two-way, interactive, fiber optic based technology to reach distance learners in effective ways and collaborating with each participating partner to increase the impact of scarce educational resources.

Collaboration

Collaboration has been an essential part of the project. A consortium was formed by both demonstration projects. The Consortium for the Advancement of Public Education, (CAPE) was awarded a training and development grant by the Bell South Foundation to assist the two demonstration projects in implementing distance education.

This grant has been used to support several joint meetings and retreats for the teachers and facilitators of the two demonstration projects to share insights and experiences. Unfortunately fiber optic linkage of the two demonstration projects was not feasible during the first year of the project.

In order to facilitate planning and the management and operation of the network, the partners of each of the demonstration projects developed smaller consortia. The business partners of Southern Bell and Northern Telecom were included in the area consortia membership. Additionally, VSI, a company contracted for the installation and maintenance of equipment in the classroom was also included in consortium meetings.

The inclusion of the business partners in the regular meetings of each consortium has been essential in maintaining channels of open communication between the technical designers of the demonstration projects and the end users. A wide, comprehensive representation at consortium meetings has afforded consortium members the opportunity to examine issues and concerns from educational, technical and industry viewpoints.

Since the beginning of the project, refinements have been made on a continual basis. Without input from students and teachers, there would have been considerable delays between when a problem was voiced and when the problem was addressed.

Independent Evaluation

Objectivity is needed to provide information for informed decision making. An independent assessment of the project was considered to be an important component of the project. Information is needed which spans the full range of the project from instruction to operation. The research firm of Evaluation Resources, Inc. located in Memphis, Tennessee was selected to do a comprehensive external evaluation. A release of the evaluation results of the first year are expected in December, 1992.

Technical Design

The Vision Carolina project is based on fiber optics, a technology which allows the transmission of laser pulses of voice, data and video signals over a thin, hair-like strand of glass. Southern Bell provided the fiber optic pipeline connecting each of the participating sites and digital switching equipment. Northern Telecom provided the distance learning software and computerized hardware, video codec equipment and fiber optic terminals. VSI was employed to install and maintain the video and audio equipment in each classroom.

The network was designed around a switched DS3 technology. A CODEC, coder/decoder, is used to send signals into each school site and direct them back to the central switching station where they are combined and sent out to other sites. A Macintosh computer in the classroom controls video displays at both the sending and receive sites.

Program schedules are maintained electronically. A distance learning software package designed by Northern Telecom drives the network.

The system has been designed to allow the network to be reconfigured on a scheduled basis through specifying the originating and receiving sites. This design provides maximum flexibility by allowing any participating site to be connected to any other site within the network.

Classes, special programs and teleconferencing sessions are scheduled on the network through a system administrator. Interactive sessions are arranged ahead of time so that the system administrator can program the switch control computer with the session schedules for all sites.

Studio Classrooms

The location of existing fiber cabling was a primary factor in site selection. Classroom selection, however, is important consideration which can impact on the success of any distance learning project.

Classrooms were surveyed by VSI and recommendations were made. Most high school classrooms required extensive grooming necessary to bring the room to certain minimum standards for audio and video.

Audio

Audio is a critical consideration for interactive distance learning projects. In general, participants are less tolerant of poor audio than poor video. Acoustical treatments were necessary in order to prevent ambient and transient noise. Commercial acoustical panels were found to be quite expensive and few sites were able to afford them. Through some research, it was found that an inexpensive alternative would be just as satisfactory and extremely economical.

A proposal was made for the sites to construct frames containing ordinary R-16 insulation material. It was discovered that if the insulation was placed with the open side out to the room and the frame covered with a burlap type sturdy fabric preferably in a blue color to enhance video quality, the walls of classrooms could be brought up to a satisfactory standard. It was determined that this alternative made substantial improvements in room audio when placed along approximately 60% of adjacent wall space.

The audio in each classroom was also greatly enhanced through carpeting each classroom and improved when the microphones were positioned on stands over the tables to prevent them from "gating on" due to the shuffling of books or papers and other transient noise.

Audio and video equipment in the classroom should also be connected to a dedicated electrical circuit to prevent the introduction of extraneous noise of other devices such as lighting ballasts and cooling compressors being on the same circuit.

Video

High quality video and audio is a necessity for distance learning applications. The high bandwidth of the DS3 circuits enables the system to realize the advantage of the higher resolution of three chip cameras installed in each classroom. Single chip overhead cameras were found to be quite adequate for picking up graphics and other information projected from the instructor's writing board. Large monitors were installed in the back of each classroom to assist instructors in seeing students at other distance locations. Additional monitors were included in the front of the classroom for the students to see the classrooms of the distance sites.

Macintosh computers were installed in each classroom to make the operation of the cameras more accessible and feasible for instructor or facilitator control within the classroom. However, in most cases instructors found the assistance of a facilitator in controlling the cameras helped them to maintain their concentration on the students and the instructional process.

Features

The network platform was designed to provide the opportunity for four sites to interact simultaneously. The limitations of a single a quad-split design were soon realized. There is a need for two dynamic quad-splits to include the additional sites in the Charlotte area project.

Continuous presence is a feature of the network which allows for up to four classrooms to have equal access to participate in open interaction without manual intervention by a studio operator or facilitator. This is an important feature which promotes the type of interaction found in a traditional classroom.

The network has also been designed to support data transmission. This feature which is currently being put into place and will provide for the merging of full motion video, data and audio over the network. Each site must purchase a router to connect a local area network to the video network. Computer transmissions from one local area network to another will greatly assist the merging of the "on-campus" site with remote computer resources and ultimately resources around the world.

A device was recently purchased for the network by UNC Charlotte which will allow the digital signals of computers to be converted to broadcast signals. This device, Willows Perpherial, allows a computer screen to be displayed on composite television monitors. This feature will greatly assist and encourage faculty who incorporate computers as part of the instructional process to become involved with distance education and utilize the network.

Instruction over the Network

The focus of this presentation is primarily on the efforts and progress of the Charlotte area demonstration project. While the two demonstration projects differ in regard to the interwoven nature of the Charlotte area project and the inclusion of a Medical Center of the Wilmington project, the two demonstration projects have been progressing in similar ways to expand distance learning opportunities in their respective regions.

The Charlotte area project has targeted three areas for the achievement of specific results through the network. These areas include:

1. To equalize access by students to outstanding programs, courses and instructors.

2. To share resources for teaching and research and promote collaboration among partners.

3. To discover the full potential of fiber optic technology for enhancing teaching and learning.

The Vision Carolina network is viewed as a tool for the sharing of limited resources across political boundaries and educational levels. For example, the network will allow schools to share classes on subjects for which there might not be enough students at an single site to justify adding a special course or a teacher. Never before have high schools in one county been in a position to share resources with another county in North Carolina.

The Vision Carolina network has positioned networked institutions to share information and resources across educational levels. Community colleges are linked with Universities and both are linked with the high schools. This linkage will stimulate many new and innovative collaborative projects.

Instructors have indicated that teaching a distance learning class is very different form a conventional class in some ways and very much the same in other ways. Teachers and faculty have not requested additional training in teaching on the system other than to have someone to show them how the system works.

For example, a physics course was team taught over the network during the first year. The teachers in this course indicated that they had to plan differently. They had to spend more time in the planning process to prevent the possibility of becoming talking heads and were challenged to rethink what they had been teaching individually to draw on the strengths of each person's teaching style.

Faculty are challenged to keep the remote class as involved as possible. This often involves pausing to give not only the class in front of the instructor time to ask questions but the remote class also.

Courses Taught Over the Network

Courses taught over the system include the high school exchange of the low incidence courses of French IV, Spanish III, Latin II and advanced math. Several University courses were added during the second year. This fall a two semester sequence of Japanese courses was offered to high school students. The Japanese courses are broadcast from UNC Charlotte to two high schools where students will receive eight semester hours of university credit. A special Financial Management course will be broadcast to two high schools in the Spring, 1993 semester. This course will be team taught and the students will receive three semester hours of University credit.

Several courses in the Masters of Public Administration program and undergraduate courses in Criminal Justice have been planned for broadcast to Gaston College from UNC Charlotte.

Scheduling has occurred on a first come first served basis. This method of scheduling has been adequate for network programming so far. However, as demand for network time increases in the near future, a priority system may be required. For example there may be a need for access time for special non-credit sessions for professional and staff development and network time may be reserved for special types of programming.

Challenges

The unique features of the Vision Carolina project have brought about challenges. The Vision Carolina project represents a major milestone in educational synergy in the state of North Carolina. New levels of cooperation have been required and achieved. Instruction is being shared for the first time across political boundaries, district lines and institutional levels.

The sharing of resources has required advance planning and often adjustments in school and instructor teaching schedules. Administrative decisions at the participating sites have been required to accommodate the needs of the all of the partners in the project. The Vision Carolina partners have been challenged to work through differences in academic calendars and class period schedules including daily start times.

Courses have been brokered across educational levels and district lines. Planning sessions have been required to achieve a greater understanding of not only institutional requirements but course management and credit issues.

Telecommunications can enliven and revitalize education by extending opportunities well beyond the boundaries of the traditional classroom. Partners of the project have been challenged to work with their faculty in exploring the full potential of fiber optic technology to enhance teaching and learning. A forum for the exchange of ideas was sponsored by the Office of Continuing Education and Extension at UNC Charlotte during the first year of the project. Faculty were given the opportunity to submit proposals and have their ideas reviewed and critiqued by the forum participants. Small grant awards were made through the BellSouth Corporation to encourage faculty to experiment with the technological capabilities of the network for the delivery of programs and opportunities that would not be possible without the use of the network.

Future Directions

During the pilot stage of the project, the number of Vision Carolina sites will not be expanded. However, planning is occurring with the future in mind.

Building and maintaining a broad base of understanding and awareness of the educational potential of distance learning technologies is critical to the continued success of the project beyond the pilot stage. Network demonstrations have been planned for schools which are not participating partners of the project. Students from nonparticipating sites have also been invited and encouraged to participate in network opportunities by traveling to one of the Vision Carolina sites.

Strategic planning and a supportive infrastructure are essential for the effective use of distance learning technologies. Not all structures are well suited for interactive distance learning. Specifications are being developed to outline the physical design, space, equipment and renovation requirements for the addition of future sites on the Vision Carolina network.

Careful thought must not only be given to the physical requirements of electronic classrooms but also to financial aspects. In addition to broadcast equipment and the lighting and acoustical treatments required for an effective distance learning environment, the inclusion of additional equipment such as a fax machine, a telephone, copier and personal computers which facilitate the convergence of video, audio, print and data transmission should be considered. These additional elements enhance the learning experience of students in an electronically mediated environment.

Merging technology and education requires a planned educational process to appropriately integrate strategies and teaching methodologies which will facilitate learning. There is a continuing need to explore and discover which teaching strategies are most effective in meeting the learning needs of distant learners across educational levels.

The Vision Carolina partners anticipate many different types of applications and uses of the network. Future uses include expansion of teaching, in-service training for teachers, teacher roundtables and alliances to enrich teacher education experiences and curricula and a continuation of the low incidence sharing of scarce resources.

An expansion of telecommunications in North Carolina is under exploration in North Carolina. This expansion may include a statewide broadband network in the very near future which may provide connectivity to as many as 2500 sites. This expansion of network sites will not only make network services much more economical but more accessible.

Telecommunications is changing the way we think about and view education in North Carolina. The possibilities for creativity and innovation in programming are almost limitless.

Distance learning is here to stay. The question will be not if there will be distance learning alternatives for students but how many opportunities can be networked together to provide the best match of services for a student's particular needs.

Telecommunications technology is a tool empowering educators from the secondary school to the graduate school level to reach students and prepare them to function in a global society. UNC Charlotte has a unique opportunity to extend its resources to the region, across school districts and educational levels, through the electronic highway of the Vision Carolina network.

ALTERNATIVE EDUCATIONAL DELIVERY:
USING INFORMATION TECHNOLOGY IN A MULTICAMPUS ENVIRONMENT

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ABSTRACT

Three concerns dominate virtually all discussion of higher education in this decade: student access, academic quality and fiscal efficiency. The California State University (CSU) has formed a systemwide commission to examine the role of emerging technologies in addressing these issues. Its charge is to develop new models of instructional delivery and information access for the 21st Century based on the latest developments in telecommunications networks and interactive multimedia. Concurrent with this effort are activities aimed at enhancing the existing technical infrastructure to support alternative educational delivery.

The CSU currently enrolls 360,000 students on 20 campuses spanning a distance of almost 1,000 miles. Like institutions across the nation, the system is confronted with facility constraints, faculty shortages, fiscal retrenchment, and political demands for greater accountability, but within a unique environmental context of projected enrollment growth of 140,000 to 180,000 students over the next 15 years.

This paper and slide presentation will describe 1) the commission's progress in developing a conceptual model and implementation plan for alternative instructional delivery in the system and 2) long range plans for infrastructure enhancement. They will be of interest to policy planners as well as technical management.

ALTERNATIVE EDUCATIONAL DELIVERY:
Using Information Technology In A Multicampus Environment

INTRODUCTION

The California State University (CSU) has launched an important new strategy to help meet the projected enrollment increases of 140,000 to 170,000 additional students over the next two decades. It is called Project DELTA which stands for Direct Electronic Learning Teaching Alternative. The project's goals are to greatly increase the role of technology in educational delivery by expanding existing CSU campus efforts in distance learning, and by promoting multi-campus cooperation in technical and programmatic areas.

Like its symbol, Project DELTA is about change. It envisions one alternative to the current way of teaching and learning among the 20 campuses of the CSU system. It builds on the long history and traditions of academe within the context of long-term fiscal challenges and significant enrollment increases projected for the next two decades, and the conditions and opportunities for change which they imply. It suggests that solutions to these issues lie, at least partially, in developing and implementing an effective teaching and learning delivery system using the learning tools of emerging information technologies.

An important assumption of the project is that the teaching and learning paradigms of the information age may be significantly different from those of previous generations, and that the educational needs of learners and scholars may require major changes in how knowledge is created, stored, transmitted, and acquired. The teaching and learning universe of the information age assumes that the boundaries of place and distance become less important as the demands of time and access for the individual become more important.

Most of American higher education will continue to evolve as it has over the past several centuries. However, some universities, like many organizations, will place a major emphasis on digital delivery systems -- interactive media (particularly video), iconic and visual literacy, and integrated modes of learning that engage all the senses of the individual learner simultaneously.

Distance education and instructional technology have been part of the CSU instructional process for many years. However, they often have developed along separate tracks. Distance learning, which includes all forms of off-campus instruction, still tends to be "non-traditional" more in terms of where instruction is delivered than in terms of how it is delivered. On the other hand, instructional applications using technology have stimulated alternatives to the lecture format but have tended to be "place-bound" in the sense that learning still occurs in a classroom setting on campus.

Most estimates suggest that the technical means for integrating these two dimensions of non-traditional instruction (i.e., delivery and format) are only a few years away. An historic merger of technologies in the telecommunications, computing, and consumer electronics industries has the potential for transforming the nature of teaching and learning as it has existed for hundreds of years. The development of ubiquitous telecommunications networks and digital-based information formats promise to bring instruction directly to the learner rather than requiring the learner to be in a specific place at a specific time in order to receive it. Teaching and learning in the information age will be less print-oriented and classroom-bound than ever before; they will also need to be less labor-intensive and more portable and modular in formats and delivery. The home and the workplace may become the classrooms of tomorrow.

The traditional delivery system of higher education has emphasized face-to-face interaction between the instructor and students in a campus, classroom environment. This approach is both labor and capital intensive, and often inconvenient to students and faculty alike. The emerging delivery systems of the information age will rely heavily on "virtual" environments; i.e., access to instruction and information resources anytime, anywhere through electronic interaction. Knowledge created by the faculty will be stored, transmitted, and accessed in digital formats using computer networks, cable, satellites, compact disks, videodiscs, and a host of multimedia tools which combine data, voice, and video information. According to some experts, fully 98 percent of all information will be available in digital formats by the end of this decade, creating a trillion dollar industry organized around digital-based media, publishing, computers, consumer electronics, and telecommunications. By comparison, the current estimated value of the personal computer industry is about 60 billion dollars.

The digital revolution already is transforming many aspects of everyday life, and the norms and values associated with them; it may do no less for higher education. Access and convenience are the hallmarks of this revolution. California represents an ideal laboratory for testing its potential. The state is physically large, densely populated in sections, socially diverse, fiscally troubled, and technically sophisticated, possessing all of the elements needed to stimulate new ways of thinking about educational delivery. The CSU has an opportunity and a responsibility to assume a leadership position in making this transition to a new instructional paradigm based on the emerging social norms, technological values, and educational expectations of the next generation of learners.

THE NEED

The need for Project **DELTA** stems from four interrelated sources: *individual, institutional, political/social, and technological*. Together they form a network of internal and external pressures on the CSU which may challenge many traditional assumptions, policies, and practices concerning the nature of higher education in the next century.

Individual expectations and demands concerning the nature and delivery of educational services are changing, largely in response to technological innovations. Increasingly, institutions of higher education will be expected to offer instructional and support services based on the convenience of consumers rather than that of campus constituencies. Education which is truly learner-centered ought to be delivered directly to the individual at a time and in a place determined by the learner. Personalized instruction of this nature depends on sophisticated delivery systems and portable learning tools made possible by the revolution in digital electronics.

But learning need not be an "atomized" experience divorced from a meaningful social context. The same systems that deliver information directly to the individual can also promote communication and intellectual interaction among students and with faculty members that equal or surpass that which is possible in traditional classrooms. The amount, quality, and breadth of interaction possible via electronic networks may enhance the learning experience while simultaneously making it more personal and convenient.

The *institutional* pressures include enrollment growth, facility deficits, faculty shortages, and fiscal retrenchment. System enrollments are projected to increase by approximately 140,000 to 170,000 students by the year 2005. Current estimates suggest that roughly 50,000 students will have to be accommodated through means other than the existing 20 campuses or academic calendar (i.e., off-campus centers, instructional technology, year round operation) once current and planned facilities are filled to capacity.

During the same period, 14 of the existing 20 campuses are projected to reach their physical limits, dictating the need for additional campuses in those areas, or new modes of service delivery. The facility needs of the system as a whole would require building the equivalent of a 10,000-student campus each year for the next 15 years. The current five-year Capital Outlay Plan projects an average annual budget of $405 million, yet funding for capital projects is based on voter approval of bond propositions which face increasing opposition and uncertainty.

Faculty resources are no more secure. Like all other institutions in the nation, the CSU is in the process of replacing an entire generation of tenure-track faculty. The system is projected to hire almost 12,000 tenure-track faculty over the next 12 years. However, the largest source of new faculty, recent Ph.D. graduates, has not increased in numbers for more than a decade. To make matters worse, fully one-fourth of the new doctorates are awarded to non-citizens who often plan to leave the country. The time required to produce a Ph.D. has grown to more than ten years beyond receipt of the bachelor's degree, so a serious lag between supply and demand is virtually assured for the next decade and beyond.

Finally, few economic scenarios for public sector institutions are positive, if recent studies are accurate. Given a host of structural obligations (notably, corrections, welfare, and debt service on general obligation bonds), the gap between state revenues and expenditures is projected to grow steadily worse during the 1990s. The competition for public resources among state agencies and among the four segments of public education is expected to become even more difficult than at present. The percentage of state general fund revenues appropriated for the CSU has declined over the past several years, and there are no indications of a significant reversal of this trend.

These four issues-enrollments, facilities, faculty, and public revenues-individually and collectively are a stimulant for a new way of thinking about higher education. Each is a major challenge, requiring responses that are equally profound. In each instance, traditional thinking offers few convincing answers for the immediate or long-term future. New and creative models of institutional planning are required.

Political/social pressures, too, are reaching new levels. Higher education is one of the few institutions in American society that historically have maintained widespread public confidence. Yet, legislative demands for accountability and efficiency dictate exploring all reasonable alternatives for the delivery of higher education services. Feasibility studies and cost-benefit models amount to good political as well as good economic sense. Higher education has the option of evaluating its alternatives, or having it done by others. The bad news is, because of the long-term fiscal crisis facing the state, public officials are demanding new and creative approaches to meeting traditional needs; the good news is, because of that same crisis, they are willing and even eager to listen to such ideas. Greater flexibility and convenience in instructional and support service delivery offer means for maintaining public support in a consumer-driven market.

Competition from private industry and from other higher education institutions within California and outside the state is forcing hard questions about traditional ways of doing business. The CSU has two choices. It can either play a leadership role in educational delivery by developing a viable alternative system within scarce resources, or it can maintain a status quo strategy and run the risk of forfeiting its leadership role and the opportunities that go with it.

Technological resources include the broad fabric of technological change, economic dislocations, and changes in cultural values and lifestyles. The recent "marriage" of computing and various forms of telecommunications can be expected to increase the scope and pace of technological innovation almost beyond imagination. The revolution in digital electronics is transforming the nature of work in every business and institution. It is unlikely that higher education can stand apart from these currents of change if it plans to be one of the nerve centers of the information age. Emerging multimedia technologies and communications networks can make learning more convenient, efficient, and effective while broadening access far beyond the constraints of time and place.

Traditionally, direct electronic delivery of education has been perceived and planned as a mechanism for predominantly rural populations. The future role of such delivery will become equally urban based among the population centers of the state. California's manpower needs increasingly are dependent on worker retraining, education for adult re-entry, and ethnic minority students. Growth among ethnically and culturally diverse populations, among the highest in the nation, requires innovative and efficient educational outreach steeped in the latest technological systems and tools. With multiple careers and lifelong learning the norm, the human capital needed for California's economic future will be educated in ways quite different from previous generations of college students.

Perhaps the most pervasive yet diffuse factor underlying the need to augment traditional approaches to higher education is the culture itself. Technology is a major influence on personal values and everyday lifestyles. Among other things, it structures public expectations about all service industries, education included. An institution rooted in tradition may have little to say to a generation of students accustomed to a world of technological efficiency and innovation. Institutional "fit" with changing cultural values, trends, innovations, and lifestyles may become a major concern of the university of the future.

All of these pressures point to a need for alternatives to traditional academic customs and practices. The very forces that are rendering traditional forms obsolete contain the seeds for workable alternatives. The missing links are a vision of an alternate future and a plan to make it happen. Project **DELTA** is a proposed response to that challenge.

PROJECT DELTA

DELTA refers to **D**irect **E**lectronic **L**earning **T**eaching **A**lternative. In mathematics, the delta symbol stands for "change." Like its symbol, Project DELTA is about change. It envisions alternatives to the dominant approach to teaching and learning in the CSU and, indeed, higher education generally--one that is print and lecture oriented, time restricted, and place bound. *Project DELTA will not replace the dominant instructional paradigm, but will supplement it.*

The project intends to build on the long history and traditions of academe, but within the context of long-term fiscal challenges and significant enrollment increases projected for the next two decades, and the conditions and opportunities for change which they imply. The project suggests that solutions to these issues lie, at least partially, in developing and implementing an effective instructional delivery system using the learning tools of emerging information technologies.

Three criteria underlie the success of the DELTA venture. First, it must sustain the *quality* of teaching and learning achieved in traditional classroom settings. Second, it must increase the amount and convenience of student *access* to higher education. Third, it must be cost-effective compared to existing delivery methods, thereby promoting greater institutional *accountability* in the use of public funds.

The project represents an innovative response to the interrelated challenges of enrollment demand, resource shortages, and fiscal retrenchment in the system. For example, official population and enrollment projections by the Department of Finance indicate that approximately 140,000 to 170,000 additional new students will enroll in the CSU over the next 15 years.

Approximately 14 campuses will approach or reach their facility ceilings in the next few years. It is uncertain whether sufficient capital outlay resources will be available either to expand existing campuses to meet this level of demand, or build new ones. Fiscal realities and prudent management require that the system explore alternatives to brick and mortar.

Project DELTA is an affirmation of the state's and system's historic commitment to higher education as expressed in the Master Plan for Higher Education. It assumes that it is unacceptable to educate proportionately fewer citizens than now, and that ways can and must be found to reconcile available resources with enrollment pressures and the economic demands attending lifelong learning. Expanding student access to higher education in California is both an economic necessity and a moral imperative. The future health of the economy requires it, and social equity demands it.

The overall goal, then, of Project DELTA is to:

Develop an alternative and effective learning/teaching strategy

to deliver academic courses and degree programs

which emphasizes direct interaction among learners, faculty, and the relevant information resources

using electronic media as the primary delivery mechanism.

The specific objectives of DELTA are to:

- Give each existing CSU campus an opportunity to extend its services more pervasively into the communities it serves.
- Facilitate intercampus sharing of program offerings, resources, and services.
- Provide a viable alternative to building additional facilities, including new campuses.

The planning phase for Project DELTA began in spring of 1992 and will extend through the summer of 1993. It encompasses five major tasks:

1. Environmental Scans--This activity involves a systematic assessment of the current environment for distance learning in higher education--internationally, nationally, and systemwide. These studies provide benchmarks for future planning, assist in identifying exemplary program and technical models, and offer preliminary insights on the potential demand for DELTA. A summary of the findings from the internal, systemwide environmental scan is presented below.

2. Program Development--This task is the heart of the planning phase and has a short-range and a long-range component. The former will build on existing CSU campus programs by expanding their scope and visibility in the system. The latter will emphasize development of comprehensive, integrated models of direct electronic delivery among the following six dimensions of the DELTA framework:

- Academic Programs
- Information Resources
- Academic/Student Support Services
- Student Evaluation and Institutional Accountability
- Administrative Support Services
- Infrastructure

3. Evaluation--An independent feasibility study will be conducted to examine the comparative costs and benefits of the long-range models which result from Task 2. The educational benefits to the individual learner and the cost effectiveness to the state will have to be demonstrated.

4. Consultation--Strategic planning of this nature requires constant communication and consultation among constituencies within the system, state policy makers, national experts, and the private sector. Several categories of constituent groups have been identified and a schedule and process for their involvement in DELTA is being implemented.

5. Endorsement--The final task in the planning phase of Project DELTA is to seek Board of Trustees endorsement of the vision of a new environment together with a plan and strategy for full development and implementation. As part of this task, a generic workplan for the implementation phase of the project will be prepared. Ultimately, several implementation plans will be developed with varying timelines and objectives.

The detailed workplan for the planning phase of **DELTA** contains the following elements for each task and sub-task: a brief statement of the *scope* and *focus* of the work in terms of the issues to be addressed; a description of the *process* to be followed; identification of the *staff* and other resources required to do the work; a *schedule* for completion of the tasks; a description of the products that will be provided; and an estimate of the *costs* for personnel, travel, and operating expenses.

INTERNAL ENVIRONMENTAL SCAN

Interviews were held with campus representatives during the summer of 1992; most lasted about 90 minutes. Personal visits were made to seven campuses, videoconferences were held with three campuses, and telephone conference calls were placed to ten campuses

The specific objectives of the internal environmental scan were to gain a general sense of the programmatic and technical status of distance education among CSU institutions; identify key faculty and administrators with expertise and interest in the broad concerns of Project DELTA; and receive the advice of campus representatives, however critical, on how to develop and manage a project of this ambition.

The CSU is a system of enormous size and diversity. Accordingly, one might expect to find little consensus among the institutions on the range of topics addressed in this study, but some patterns did emerge from the campus profiles. Following is a summary of the dominant ones.

Academic Programs

1. Distance learning still exists at the margins on most CSU campuses; it has not been fully institutionalized into the credit, state-supported portion of the curriculum. Most credit off-campus programs are quite small compared to the enrollments and range of offerings available on the main campus.

2. Most of the courses and degree programs in distance learning are concentrated in professional disciplines such as business, engineering, health professions, and law enforcement, in part because these employment sectors offer easily identifiable groups with specific educational needs in large physical settings, and because of their ability to underwrite the cost of electronic delivery. Still, a fair amount of general education and liberal studies courses are offered as well.

3. Much of the distance education in the system is non-credit and occurs in certificate programs, seminars, and workshops offered through extension divisions, although the pattern varies by campus. Some campuses offer only credit courses in distance learning, others only non-credit, others both types, and a few neither.

4. Faculty teaching in distance education are a mixture of tenure-track professors and part-time lecturers. Most campuses attempt to preserve the same mix that exists in the regular curriculum. The conditions of employment for distance learning courses are mostly ad hoc arrangements between the individual faculty member and his or her department; on occasion, release time or a modest amount of technical support may be provided. Support for such activity among the faculty as a whole (including senate and union representatives) has generally been positive but cautious. As faculty involvement in distance learning increases, latent concerns may become more vocal. However, virtually every campus has a pool of faculty with technical expertise and practical experience in distance learning and, on a systemwide basis, all major disciplines are represented.

5. The lecture/classroom paradigm still dominates distance learning in the system, particularly in credit courses. The use of computers, multimedia, and advanced telecommunications (i.e., something other than telephones and televisions) is very limited.

Information Resources and Support Services

1. Provision of advising services and library and computing resources to distance learners is a persistent problem, but most campuses have implemented a range of practical solutions, technological and otherwise. Electronic access to library resources appears to be gaining ground everywhere.

2. Academic and student support services are major concerns of WASC and discipline accrediting associations. With only a couple of exceptions, campuses reported that accreditation had not been a problem.

3. Most distance learners are older students with fewer needs for traditional student support services than exist on campus. Still, policy regulations plague financial aid services and logistical barriers often limit student access to advising, registration, and bookstore needs. Many of these latter services are delivered on-site by faculty or course coordinators.

Program Administration

1. Funding for distance education is a mixture of self-support, private donations, federal grants and state revenues. Almost without exception, resources for equipment and the technical infrastructure to support such learning have depended heavily on these first three sources.

2. Automation of administrative logistics and data processing for distance learning programs has lagged far behind that for the regular campus curriculum. Heavy use is made of telephones, facsimile machines, and manual service as opposed to computers.

3. Inter-campus sharing of programs, faculty, and technical resources is very limited. Much of the telecommunications infrastructure that does exist (CALNET, CVMN, CSUnet) is greatly underutilized compared to its capacity.

4. Programmatic and technical linkages to high schools for distance learning is highly developed on some campuses, but virtually non-existent on many others. Similarly, a few campuses have established strong ties to community colleges (particularly when the latter's facilities are used as sites for off-campus instruction), but the potential for such liaison among the state's 107 community colleges is only beginning.

Evaluation and Accountability

1. Most campuses had performed some modest amount of evaluation of their distance learning programs. Without exception, they reported that students were satisfied with the experience and performed as well or better than students in comparable courses on campus. Faculty evaluations and accreditation reviews were also positive.

2. Few campuses were willing to argue that distance education, as presently conducted, resulted in a net cost savings compared to traditional instruction. The key factor in the equation is enrollments and the economies of scale which could be achieved through greater use of technology. The relative trade-offs between traditional capital outlay expansion on the one hand and investment in technological infrastructure on the other were unclear to most participants. More study of this point is needed.

Infrastructure

1. Although many types of delivery systems for distance learning are available on CSU campuses (computing, satellite, cable, microwave, compressed video), the primary mode of distribution is ITFS--it is one of the oldest technologies. There is significant interest on most campuses in developing their satellite, cable and compressed video capabilities.

2. Campus involvement in distance learning is heavily dominated by the concept of "place," primarily in the form of off-campus centers. Planning for a world of ubiquitous communications networks which are not tied to time and place has not captured the imagination of faculty or academic planners on most campuses.

3. Campus master plans for technology tend to be internally-oriented (wiring the campus) rather than externally-oriented toward the community, state, and nation. Similarly, while there is a great deal of faculty interest and expertise in multimedia applications, they are more likely to be used for on-campus instruction rather than for distance learning.

On balance, there is an unevenness among the 20 campuses along these dimensions related to distance learning. Some have a strong intra-campus investment in technology, while others are establishing links to high schools and employment centers in the community. Some have made special efforts in the areas of libraries and support services for distance learners, and still others are only in the beginning stages of moving from classroom instruction to distance education. The age and size of the campus, the nature and size of its service area and population, and the vitality of its extension and media divisions all contribute to its present status in and future plans for distance learning. The advantage from a systemwide perspective is that all of the disparate threads needed for a more integrated approach to distance learning already exist somewhere in the system.

TECHNOLOGICAL INFRASTRUCTURE: CURRENT AND PLANNED

A major part of the infrastructure that will undergird any serious attempt at alternative education delivery in the CSU will involve telecommunications. Historically, the CSU has considered telecommunications infrastructure as a "network of networks," which has three tiers.

The first tier is an appropriate intra-campus telecommunications infrastructure with adequate voice, data and video communications. The second tier is a systemwide network which not only provides access to shared resources, but facilitates cooperative ventures between or among campuses and between campuses and their service areas. The third tier is access to global external resources (databases, specialized services, etc.) which are necessary to empower students, faculty and staff in their roles as learners, teachers and scholars, and information workers.

The CSU's goal relative to alternative instructional delivery is to achieve a level of communications capabilities which facilitates the delivery of instruction and support services. This will enable students, faculty and support staff to communicate electronically, and to readily access distant information resources from anywhere at anytime. In order to do this, a telecommunications infrastructure must address on-campus networking, connection of the campus to its service area, and the ability of campuses to collaborate with each other to serve systemwide needs.

One of the major resources in the CSU for providing campus to campus connectivity and systemwide access to global information resources is CSUnet. CSUnet is a private wide-area network connecting the twenty campuses of the California State University as well as other educational institutions throughout California. Its basic goal is to provide equal access to information resources for all faculty, students and staff, regardless of their location.

Currently, CSUnet provides T-1 connections at all CSU campuses. A T-1 circuit down the California Aqueduct, on the Department of Water Resources fiber network, is also part of CSUnet. The CSU operates this circuit on behalf of the California Internet Federation, and provides transit traffic rights to this bandwidth to other California education networks. CSUnet is connected to the National Science Foundation Network, NSFnet through Stanford (from San Francisco State) and the San Diego Supercomputing Center (from San Diego State).

CSUnet began as a data network in support of campus and systemwide administrative and academic computing activities. Today, the major use of CSUnet is still for data communications; however, the architecture of CSUnet has allowed the system to overlay compressed video signals onto the network and video is becoming an important inter-campus application. Over the last year or so, several CSU campuses have delivered courses either to remote locations in their service areas, to local high schools for advance credit, or to other CSU campuses. CSUnet provides the highway over which students at one site have two-way interactive communications with the professor and students at the distant site.

Of particular importance is the utility of this application for serving student needs at off-campus centers. California is a large, geographically diverse state. Several CSU campuses have found it necessary to establish off-site centers to overcome the problems associated with distance and/or commute time. Use of interactive, compressed video allows courses and student services such as advising and financial aid counseling to be offered at remote locations without having to incur the expense and wasted productivity of sending faculty and staff to the sites. CSUnet plays another role in assuring that students at off-campus centers are fully connected to all campus electronic resources, including the full range of library databases.

While compressed video is the newest video communications medium and the one which can be used over CSUnet, other video technologies have existed for many years in the CSU. Instructional Television Fixed Services (ITFS) is a broadcast microwave system used extensively for the delivery of education to areas outside the geographic boundaries of the campus. A total of fourteen CSU campuses have ITFS capability. For example, Cal Poly Pomona teaches classes through ITFS at dozens of K-12 locations in Southern California. Five Los Angeles basin campuses (Pomona, Dominguez Hills, Long Beach, Los Angeles, and Fullerton) have entered into a consortium called CALNET. These campuses share four channels which are owned by the CSU. The consortium is currently investigating the feasibility of offering a joint degree program in cooperation with the City Of Los Angeles' educational cable television channel. The CSU has a Central Valley Microwave Network which connects Chico, Sacramento, Fresno and Stanislaus. It is often used for course sharing and sometimes for administrative conferencing as well, particularly in conjunction with CSUnet.

All CSU campuses have satellite downlink capability. The CSU owns and operates a mobile uplink truck which is housed at Sacramento but is available to all CSU campuses. CSU, Chico has developed an extensive network for the delivery of education through satellite technology. The owners of multiple C and Ku Band satellite uplinks, they can reach at least two-thirds of the globe and plan to reach more within the next five years.

A major effort to connect campuses to their service area will involve expanding ITFS capability, particularly as the digitization of microwave frequencies, and therefore greater channel utilization, becomes cost effective. The CSU envisions increased use of private-public partnership arrangements. As wireless cable operators seek to use spare campus ITFS capacity for their commercial enterprises, the CSU may be able to negotiate for equipment and services which will allow the system to reach heretofore unreachable areas. In addition, there will be an expansion in the use of cable television facilities for campus connectivity to their service areas.

Satellite transmission may prove to be a primary technological tool for multi-campus or systemwide initiatives in alternative delivery, and therefore access to uplink facilities will have to be improved. Again, the CSU is attempting to take advantage of the digitization of satellite transmission. Although every campus has a downlink, not all have an on-campus video distribution system which allows programming to be efficiently distributed throughout the campus.

The future for alternative instructional delivery in the CSU involves the integration of CSUnet with existing microwave networks and satellite capability and the connection of CSUnet to virtual private video networks, such as the Sprint Meeting Channel®. This will provide enhanced opportunities not only for distance education but for administrative teleconferencing as well. The CSU does not intend to limit itself to any one technology. Rather, the application or program being considered for alternative delivery should drive the technology. The goal of the CSU is to provide an infrastructure which gives faculty and staff the necessary flexibility to utilize alternative delivery methods in the most appropriate and effective manner possible.

CONCLUSION

It is tempting to be skeptical about the possibilities for revolutionizing teaching and learning styles to any significant extent; after all, the current system has lasted for hundreds of years, and there is almost no convincing evidence that either television or computers has changed the basic instructional paradigm or challenged its underlying academic culture. What is different? At least three factors are worth considering.

First, the norms and values of everyday life are in the midst of an unprecedented social transformation. Increasingly, the constraints of time and distance in human communication are measured in seconds rather than miles or hours. The acquisition of knowledge and the cultivation of understanding requires access to information sources and interaction with them. For the first time in human history, logistical considerations associated with time and place are being rendered irrelevant in this process as they, simultaneously, assume greater personal significance and value. Future generations of college students, stimulated by visual imagery and accustomed to the technical artifacts of immediacy, may exhibit little patience with the teaching and learning styles of an earlier age.

Second, higher education needs new definitions of interaction and of experience in the learning process. In simulated environments, human interaction can occur through electronic channels, and experience with technical issues can be gained through virtual contact and experimentation. The ability of computers, telecommunications, and multimedia tools to provide interactive, experiential learning is increasing at an exponential rate, and they usually engage the senses as well as the mind. The ultimate challenge is one of delivering these learning resources and experiences directly to the individual student in a time and place of his or her choice.

Third, higher education is increasingly competitive. The corporate sector is investing heavily in education and worker training using technology, and scores of colleges and universities across the nation are moving toward greater use of telecommunications and distance learning. Expanding the use of alternative delivery may be less a matter of choice for the CSU than one of merely keeping pace with the educational environment of the next century.

In general, Project DELTA represents an innovative response of the CSU to some historic challenges and opportunities facing the state of California, higher education, and the system itself. The state is in the midst of an unprecedented fiscal crisis affecting both the public and private sectors. Because higher education represents the single most important factor in promoting long-term economic growth, competitiveness, and social mobility in California, the CSU is in a unique position to contribute to a new economic order. It represents the largest state investment in human capital in the nation and therefore is vital to any statewide plan for economic restructuring and growth. Social and political stability rest on an educated citizenry and a productive workforce.

The project is a prudent and responsible planning activity for an institution largely dependent on public funds, and on whom the state in turn depends for skilled manpower. But DELTA also is a bold response to new economic, social, political, and technological realities. It offers one means for addressing the short-term problems of higher education in the state (fiscal retrenchment, facility deficits, faculty shortages) while simultaneously promoting the state's long-term social and economic interest in maintaining access to education among a growing and diversified population.

Project DELTA is a plan for achieving productivity gains in the delivery of higher education by making full use of the infrastructure and learning tools of the digital revolution. Its goal is to maintain or enhance the quality of teaching and learning for more students and with fewer resources than would be possible through traditional channels. It does so by placing the individual rather than the institution at the center of the process, and by delivering instruction and information resources directly to learners.

The current economic and political environments are providing the incentives for innovation, and the emerging technological environment is providing the raw materials for achieving it. Yet the critical link is the culture - the paradigm - of teaching and learning itself.

For some, Project DELTA may be perceived as a challenge to many of the traditions and assumptions underlying higher education. For others, it is a model of higher education that is long overdue, and one in concert with the broader currents of social and cultural change in the twenty-first century. With so much on the line, the project must be attentive to both perspectives, and will require the involvement of everyone with a stake in its outcome.

PC-Based Multimedia: An Opportunity to Redesign the Learning Process

by
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Abstract

Enhancements to the educational process in terms of effectiveness, efficiency and presentation flexibility are of interest. Recent developments in PC-based multimedia provides the capability to address the educational process in new and innovative ways. This presentation will discuss the components of the traditional educational process and propose a new process. The new educational process demonstrates how today's multimedia technology can be used with personal computers to provide more flexibility and time for educators to expand the content of their courses. In addition to the new educational process, a software program, "Teacher 2000", developed to illustrate how lectures can be conducted, will be presented. Teacher 2000 includes the necessary functionality to use text, graphics, still video, animation hypertext and motion video in achieving the new educational paradigm.

Introduction

Most of today's classroom time is spent disseminating knowledge through the traditional lecture method. Although this method offers the advantage of being able to sequence and augment the textbook material in a live classroom setting, it leaves little time to engage in other learning activities. Multimedia programs built for the PC offer the opportunity to create lecture material complete with text, graphics, pictures, audio, animation and motion video that can be viewed and replayed as many times as desired, at the convenience of the student. The interactivity and quality of presentation materials afforded by multimedia on the PC can be much richer than what is experienced in today's classroom. Additionally, it frees up class time to engage in other learning activities that are not possible using today's format for education. The following sections will discuss: (1) the trends noted in the evolution of the PC technology, (2) the educational considerations of using the new technology and (3) discuss Teacher 2000, a multimedia program developed to demonstrate how PC-based multimedia can be used as a vehicle to enhance the learning process.

Trends in PC Technology

It is obvious that PC technology is advancing at a rate faster than the larger computer systems. This is particularly true with respect to technological features. In fact, many of the larger computer systems are being replaced by networks of PCs in client/server arrangements. The ability to house audio, photographs, animation and motion video on the PC came about faster than most people could expect. Even today, with these new abilities being demonstrated across the world, most people do not know that PCs possess these new abilities. In addition to the multimedia capability, PCs will soon be made smaller and possess cellular communications capability. Screen technology will improve until all PCs, including portables will have photographic quality. Keyboards will become a secondary input device, being replaced by speech recognition and the use of a stylus for free style handwriting recognition. The evolution of PCs indicates rapid changes with regard to faster processors, smaller size, wireless communication, speech and hand writing recognition, significant increases in storage capacity, high speed networking and full multimedia features. All of these technological advancements are emerging faster than expected. This leaves society, and in this case education, with the opportunity to redesign the way that we do business. By taking advantage of the numerous advancements in technology, education can reach more people and allow students more flexibility in taking courses. In addition to convenience, the content of the learning materials can be significantly enhanced. The proliferation of PC technology requires a more intense and informed approach to strategic planning, if the opportunities afforded by these technological advancements are to be exploited to the fullest. This planning effort not only requires re-engineering the process of education, but additionally, will require changes in the organizational structure to accommodate the paradigm shift. In order to understand new approaches to the educational process a review of the existing and traditional methods are necessary.

Modes of Learning

The more common activities that we observe in education today include lecture, reading, application and testing. Although all four of these activities may vary from course to course, lecture can be found to consume the most class time of the four. Accordingly, accomplishing lecture in a different manner could free up additional time for other activities and also provide an opportunity for students to obtain lecture material in a more flexible arrangement. One approach to improving lecture efficiency is to examine the different methods by which to conduct lecture.

Formats for Attending Lecture

Four possible formats or methods can be considered when evaluating the alternative ways to disseminate knowledge or conduct lecture. These include same time same place (STSP), same time different place (STDP), different time same place (DTSP) and different time different place (DTDP); see figure 1.

Figure 1

	Same Time	Different Time
Same Place	Typical Classroom Lecture STSP	Prerecorded Lecture DTSP
Different Place	Teleconferencing STDP	Portable Prerecorded Lecture DTDP

The most common method used today is STSP. Considering that students and faculty have to travel to be in the same room at the same time makes this method the most constrained in terms of logistics and time management. STDP offers flexibility with respect to location but requires a complex set of equipment in order to achieve teleconferencing. A prerecorded method offers the most promising alternative and additionally, is in alignment with the trends in computer technology (DTSP and DTDP). With multimedia becoming the next major innovation in computer technology, the notion of prerecorded materials is inevitable. We now have the ability to prerecord video with audio and play the video back on a PC. By using one of the multimedia authoring tools that are available, a video can be augmented by a rich set of illustrations (i.e. graphics, text and animation). Additionally, the student can have complete control over watching the video as many times as desired. One scenario that is possible today allows the student to watch lectures at a multimedia equipped lab at school any time the lab is open. A more futuristic scenario suggests that affordable home computers both desk top and portable will have the ability to play these multimedia productions; thereby, allowing maximum flexibility. These new possibilities offer an opportunity for educational institutions to re-engineer the educational process and provide educational opportunities for a larger segment of society with a more content rich set of materials.

New Educational Format

One possible format for conducting education would entail the prerecording of lectures and with the use of a multimedia authoring tool the integration of these lectures with content rich support materials. These support materials would include the normal displays shown on chalkboards and overhead projectors but additionally, offer interactivity and hypermedia features. Since the majority of class time is used conducting the lecture, and we prerecord lectures so that the students can view them in the multimedia lab, we now have a significant amount of time released that can be used for other learning activities that cannot presently be performed due to time constraints. This available time could be used at the instructor's discretion, but hopefully would be used to allow students to gain experience in applying theory and concepts to real world problems. This would serve to assist industry by enabling students to acquire a more practical education instead of relying on industry to do the real world educating once a student is hired. One approach to bringing real world examples into the class could involve the use of video cases that allow the use of portions of the conceptual and theory material covered in the textbook and lecture. This can be easily accomplished with the multimedia capability available in today's PCs. One example of a tool illustrating the multimedia capability necessary to conduct education in the fashion discussed is "Teacher 2000", a program designed by the author to address this specific goal.

Teacher 2000

Teacher 2000 is a multimedia software program that allows a student to interactively view a lecture augmented by other reference materials. The Teacher 2000 screen is divided into three basic areas each serving a different purpose (see figure 2). The areas include: (1) a lecture window where a video of the lecturer can be viewed and controlled, (2) an electronic chalkboard used to display all text, graphs, pictures, animation and additional motion video referred to by the lecturer and (3) a notes window for taking notes that will be reviewed/addressed at a later session. Teacher 2000 gives the student the ability to view a lecture, stop it at any point and make notes on points not clearly understood. The student has the opportunity to take as many notes as desired by using the scrolling feature in the notes window. Other capabilities include the option of moving back and forth through the lecture as many times as desired. By pausing the lecture, a student can obtain more information on a topic by clicking the mouse on certain items on the chalkboard.

Looking at figure 2, it can be seen that a second window has popped up on the chalkboard. This illustrates the ability to click on key words or symbols and instantly get supplementary information on the topic clicked. This new process would allow teachers to off-load the bulk of the lecture material to a computer where the student can review the lectures with supplementary material as many times as needed and at their convenience. It further allows the instructor to create much richer and professional forms of information by using other software packages to prepare educational materials. Additionally, this approach also provides a means for instructor(s) with multisection courses to pool their ideas, thereby creating a much more complete and standardized presentation of the material.

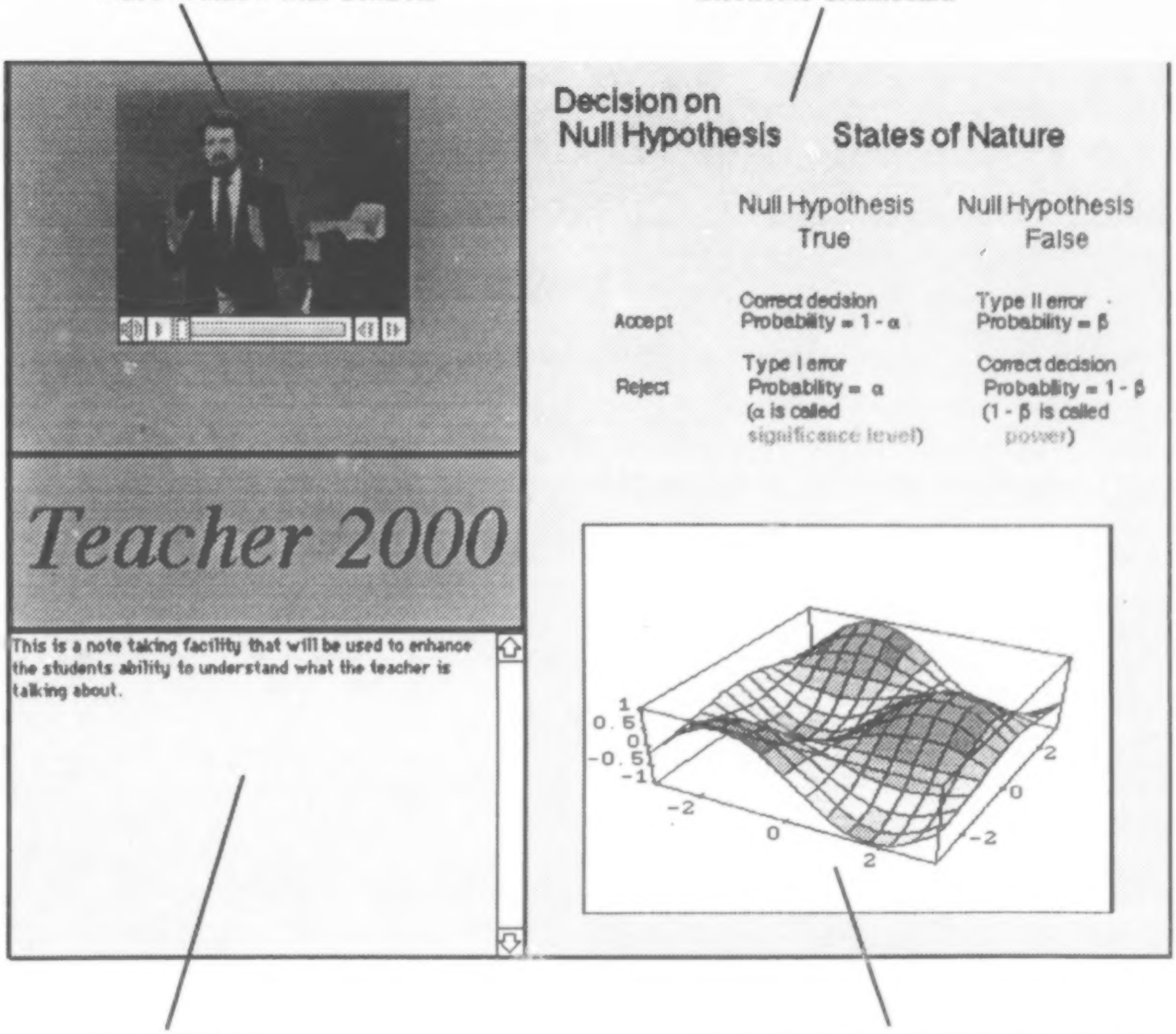
Conclusions

The advancements with multimedia provide educators with an unusual opportunity to take advantage of a new set of capabilities that will certainly be felt throughout our society. While the traditional educational format has not been significantly changed for many years, multimedia provides a delivery vehicle that has the potential to revolutionize our educational process. With the capability of restructuring the entire delivery mode in combination with powerful computing capabilities, multimedia allows educators to be much more creative with the development of educational materials. The rate at which educators will promote the use of multimedia will depend on the leadership, philosophy and availablity of this new technology at their institutions. Although technology is not a cure all for what ails us, multimedia provides our profession with some unusual opportunities to make learning a more enjoyable and interesting experience.

Figure 2
Teacher 2000 Screen

Video Window with Controls

Electronic Chalkboard



Teacher 2000

This is a note taking facility that will be used to enhance the students ability to understand what the teacher is talking about.

Decision on Null Hypothesis	States of Nature	
	Null Hypothesis True	Null Hypothesis False
Accept	Correct decision Probability = $1 - \alpha$	Type II error Probability = β
Reject	Type I error Probability = α (α is called significance level)	Correct decision Probability = $1 - \beta$ ($1 - \beta$ is called power)

Notes Window

Hypertext Window invoked by clicking on the word power

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APPLICATION OF EMERGING TECHNOLOGY TO DEMONSTRATE EFFECTIVE DISTANCE LEARNING THROUGH A TELECOMMUNICATED INTERNATIONAL BUSINESS SIMULATION

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ABSTRACT

Integration of information technology beyond specific courses in the academic discipline is a requirement and responsibility of faculty across disciplines. The opportunity exists to advance traditional teaching and learning paradigms into more exciting, interactive learning exchanges through telecommunication. Resistance to pedagogical changes through the utilization of technology is partially due to the lack of tested models available to facilitate this process. This paper will provide a "field tested" model to serve as a template to assist faculties across disciplines to enhance instructional delivery through telecommunicated technology.

Application of Emerging Technology to Demonstrate Effective Distance Learning through a Telecommunicated International Business Simulation

Need for Curriculum Innovation

Integrating information technology beyond specific courses in the academic discipline is a requirement and responsibility of faculty across disciplines. The mission of academic institutions to prepare students for the future world of work requires administrators and faculty to incorporate technology into teaching and learning processes in courses across the curriculum.

Highly skilled workers emerge from a technology-based educational program. Quality of work life and competitive advantage will reside with countries and organizations that promote high-performance through highly skilled workers. Front-line workers with the responsibilities of managers for decision making and quality control require technology-based skills (Marshall & Tucker, 1992). Information technology allows companies to restructure in this manner as new software makes information for decision making instantly available to line workers.

Managers and executives are also expected to utilize technology to monitor organizational performance comparing across time and other bases. Graphic programs distill complex data into easy to comprehend charts and graphs. Modeling programs and data management programs allow managers to project multiple scenarios, and networks provide access to a broad range of information from diverse data bases. The next generation of technology will provide broader and deeper applications of artificial intelligence and its various components for improved organizational performance (Hertz, 1988).

Information technologies also provide the foundation for international competitiveness. Industrial countries are developing technologies, building infrastructures and promoting industries to accelerate their economic performance (Davis & Davidson, 1991). International businesses and strategic alliances require knowledge of technology based communication systems as well as knowledge and understanding of other cultures and countries.

Integration of information technology into course work can provide an international, global experience for students by using the Internet instead of incurring costs of travel and study abroad. Internet is a worldwide network the interconnects numerous educational and research networks. It is a cooperative consisting of educational institutions, private corporations and government agencies and some professional groups and individual researchers. The user base of Internet is estimated to include 1,000,000 host computer sites accessed by four million individuals worldwide with more than 7,500 connected networks in over three dozen countries (Query, 1992)..

Widespread use of communication networks and technology can render political boundaries transparent and accommodate large distance and time zone differences, providing more knowledge and understanding of cultures through personal exchanges of information. Students are provided an opportunity to expand learning to international problems and an opportunity to participate in the emerging global society. Faculty as well as students are able to develop competence in computer technology as well as cross-cultural interpersonal skills.

Simulation Template

The Telecommunicated International Business Simulation (TIBS) was conceived at the University of Hawaii, College of Business Administration, during the spring semester of 1992. It involved students in both graduate and undergraduate courses in business and in Japanese language for business at the University of Hawaii and graduate students at the Institute for International Studies and Training (IIST) at Shizuoka in Japan. The students enrolled in the courses at IIST were from nine different countries in Europe and Asia as well as Japan The students enrolled in the courses at the University of Hawaii were local students from the state of Hawaii and some from other states. Students at each location communicated interactively with their remote counterparts using multimedia in real-time and delayed-time. They cooperatively engaged in course work in order to exchange business information relative to the simulation.

Students discovered, explored and came to understand cross-cultural differences in work ethic, language structure, values, beliefs and behaviors from the experience of interacting with each other on business issues. They gained valuable insight into international and cross-cultural business issues, e.g., negotiation, business strategies, human resource management, dispute resolution, industrial relations, computer technology and business terminology. The students experienced multimedia and telecommunication across cultures and distance. The understanding of cultural differences and culturally appropriate ways of doing business greatly enhanced their preparation and appreciation for the global marketplace of international business. These skills can best be acquired through experience-based learning.

Narrative Description of Project

As a result of the increasing power and sophistication of communication and computer technologies, distance education has surpassed traditional correspondence as the main medium for non-classroom instruction. Through distance learning, students and professors located thousands of miles apart may successfully explore, experience and understand each others international business environments. The result is a wider geographic dissemination of material and more efficient allocation of resources while achieving greater effectiveness in delivering knowledge from experience instead of description. As a consequence, opportunities are generated for learning experiences not otherwise attainable for either students or faculty.

Students in Hawaii were organized into teams, with each team matched to a team of students in Japan. Each Hawaii team and each team in Japan participated in two roles in the simulation. One role was as entrepreneur seeking to establish a business at the remote site. The second role was that of a local consulting firm engaged by the remote entrepreneur seeking local assistance in establishing a business at the consultant's location. The nature of the business was determined by the students and could be situated in the industry of their choice.

Undergraduate students enrolled in a Japanese language for business course joined each team from the College of Business. Students enrolled in a business English course in Japan joined each team in Japan. Although the common language of this project was English, the undergraduate students from the Japanese language for business class served as language consultants to assist with pronunciation, proper introductions, and basic phrases in the Japanese language. The language students also provided information on culturally appropriate business practices in Japan. Through this applied experience with the technical language of business a dictionary of business terms was compiled for dissemination among the teams as well as a video presentation developed as a training tool.

The project allowed students to communicate with their counterparts abroad through the use of modern but proven technology. Multiple modes of telecommunications were used: video phone, facsimile, electronic mail and electronic file transfer programs. Some of these methods permitted messaging to accommodate the time zone differences between the two sites, and others required simultaneous availability at terminals. The first category included electronic mail (e-mail), electronic file transfer (ftp), voice mail (v-mail), and facsimile (fax). The second category of communication included conventional telephone and video phone.

Textual readings for the course were delivered in a hypertext format in downloadable files. Questions from instructor to students stimulated thinking, along with a forum among and between students and instructor. This format allowed a high level of interaction, in raising questions and sharing access to the ensuing discussion. An additional stage in this project was the development and delivery of graphics and other media to supplement the textual, graphics and video materials were mailed, others downloaded via file transfer.

Video phone service was provided in Hawaii at the University of Hawaii Peacesat (communication satellite) facility. Computer equipment for e-mail and file transfer were available at various University of Hawaii computer laboratories and students were allowed to use any computer resource with local dial-up capability. Voice messaging and facsimile service were provided in Hawaii by the Department of Management and Industrial Relations and funded by a research grant from the Center for International Business and Research in the College of Business Administration.

In addition to traditional entrepreneurial international business curriculum, behavioral patterns, attitudes, values and beliefs were explored in meaningful ways through the variety of modes of bi-directional interactions. Classroom discussions concerning the nature and implications of these differences were explored experientially, greatly enhancing the learning process.

Business Project Options

The particular business to be planned in the simulation was any one of several types within the following constraints. It could range from an individual enterprise, to a joint venture between organizations in Japan and the United States, to a wholly owned subsidiary operation. The business could engage in manufacturing, retailing, wholesaling or a project venture through a strategic alliance. It could have been predominantly service oriented or product oriented, and could have been either labor intensive or capital intensive. The business plan could anticipate a work force of any size between 50 and 500 employees requiring varied skills. It could deal with product or service units of any value, inexpensive or precious, and could anticipate a long-term or short-term existence.

Scope of the Business Project

The planning for the business could include a full spectrum of issues, but with a strong emphasis on human resource management. Concerns about cultural differences emerged in relation to language, legal and regulatory obligations, economic, financial and accounting requirements, and marketing and management constraints, that impinged on the particular businesses. Resource faculty were available in both locations to guide teams in addressing these issues. In addition, students and teams assisted each other collegially in a collaborative rather than competitive atmosphere.

Before the third week of the semester, each student or team submitted a brief proposal outlining the specific structure of their business to the local faculty member. Approval or suggestions for revision were returned within three days of submission. The proposals described the business in terms of the design options permitted.

Each student and team submitted a comprehensive report to the local faculty, describing the benefits from the experience, along with a learning log on the simulation. This report described the way the simulation was conducted, the problems encountered, the solutions attempted, the successes achieved and failures endured, the conclusions drawn from the simulation, as well as the benefits derived from the experiences.

Outcomes

Many behavioral patterns, attitudes, values and beliefs were explored in meaningful ways from these interactions. Students reported being better able to comprehend and internalize the cultural differences related to work ethic, negotiation styles, strategy development, human resources management, dispute resolution, industrial relations, computer technology and business etiquette. In addition, they gained experience and skills with multimedia and telecommunication technology across cultures and distances, a critical skill in the world of international business.

The multi-modal technologies utilized in this project provided a skill-based learning experience as well as a traditional conceptual, information-based learning experience. The skills required to utilize the technology necessary to meet the course requirements are critical skills for students to enhance their marketability. These are the skills required of an educated work force for today's organizations. This project provides a model easy to replicate in any course regardless of the discipline. No tradeoff is required to incorporate skill-based learning into traditional curricula. Telecommunicating merely provides another data base of information to access.

This project provided a vehicle to demonstrate that joint development of new methodologies and paradigms can be utilized to update and rejuvenate current curricula. Future replication and expansions of this model will produce continued growth, development, and research possibilities for faculty as well as students. Comprehensive multimedia instructional materials and demonstration media are currently being produced for broad application and exposure of the simulation so others may better understand, replicate and further develop their instructional methodology.

Simulations of this nature meet the need for more culturally-relevant, student-directed instruction. The simulation provided a vehicle for discipline-focused pedagogical research which evaluated the effectiveness of teaching and learning methods in a multicultural as well as multi-modal context across large distances and time zone disparities. A review of the literature in distance learning, and cross-cultural and international business instructional methodology reveals little structured research in these areas.

Matching Funds

The matching funds for this project were provided by an international business communication organization. The organization is a revolutionary learning network which allows students throughout the U.S. to communicate via computers and video telephones with partner students around the world. Corporations are an excellent source of funding and/or contributions of hard/software. A Conference Board Report states that U.S. companies contributed over $2.43 billion from 1990 - 1991 to support education (Blumenstyk, 1992).

Evaluation Plan

The research design for this project covers a three year period with various modes of communication being changed as the test variable while other issues remain fixed as controls. New geographic locations and cultures will be added each semester as well. The learning outcomes from each group will be measured with each subsequent group, with all other factors being held constant. Data gathered during the project will be of several types, including the following: narrative responses to survey questionnaires, narrative and numeric results of structured interviews, course project reports, self-evaluation of cross-cultural skill development, and examination results.

This project will be evaluated by experimental and comparative techniques. The project structure requires establishment of two experimental groups, one at each site, and two control groups attending the same course with the same faculty member at each location over the three year period. The evaluation will compare measurement of learning outcomes between the groups, statistical analysis of data generated and interpretation of results in light of distance learning and current educational theory.

The geographic location of the University of Hawaii and the mission statement of the College of Business is consistent with the development of distance learning curriculum. The theme of the current administration has been building alliances both locally and in national and international setting. One distinctive achievement of the institution is the widening of formal ties with institutions of higher learning around the world. Projects of this nature encourage international collaboration with other institutions and faculty which lead to globally educated and connected faculty who contribute to a greater understanding of intercultural interactions as well as commit to curricula improvements.

The Telecommunicated International Business Simulation represents a unique and creative experience giving students the opportunity to develop international networks as well as critical international business skills. Fear, frustration, and failure to "make time" to adapt traditional curriculum will create and perpetuate the "computer illiterates" of the next century. To improve the quality of education through technology means to improve the quality of teaching by enlarging the resources available to faculty and providing the training required to incorporate technology into course planning (Rossman, 1992). Students should not be primarily recipients of information but collaborators in the pursuit and creation of knowledge. Instruction can no longer be solely based on what is already known but should strive to utilize what is known to create new knowledge and information bases.

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BESTNET: An Electronic Home For International Communities of Interest

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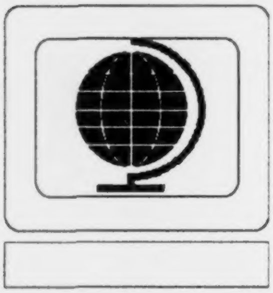
BESTNET



ABSTRACT

This presentation describes the activities and future directions of BESTNET, an international consortium of universities and other entities to promote the effective use of information technology and electronic communication tools to encourage interinstitutional cooperation for the purpose of enhancing teaching, learning, research and community service. Established in 1985, BESTNET has evolved into a dynamic, developing organization of people, institutions, tasks and technology. Its future success almost certainly lies within the domain of further international development.

INTRODUCTION/BACKGROUND

I am often asked the deceptively simple question, "What is BESTNET?" Presumably that is why most of you are here today. In order to respond most effectively, we have developed a body of written and electronic materials which not only describe the specific objectives, features and activities of BESTNET, but which also attempt to convey the "feel" of BESTNET as a powerful instructional resource. I will spend some time in this presentation going over these materials with you, but also want to leave an ample period for questions and discussion you might consider useful.

Before we launch into the "What is BESTNET?" question, let us briefly review its origins. BESTNET (an acronym for "Binational English Spanish Telecommunications Network") was established in 1985 by Dr. Armando Arias and Dr. Beryl Bellman through support from FIPSE and the Western Behavioral Sciences Institute, with cooperation from Digital Equipment Corporation. At this time, the primary objective was to develop a series of Spanish/English distance education video courses with an increasingly-pronounced use of a computer conferencing component. It was this aspect of the project which moved BESTNET into its next state of development.

In early 1991, Digital Equipment Corporation expressed its continuing interest in BESTNET by awarding an equipment grant of nearly $300,000 to selected institutions to pursue a multi-year research agenda to better understand the impact of this technology in a multicultural educational setting. Shortly thereafter, a governance structure consisting of a 9-member institution board of directors was established to further the various activities and objectives of the BESTNET enterprise.

BESTNET

Established in 1985, BESTNET is an international consortium of universities and other entities with a special educational mission. BESTNET was created to promote the use of information technology and worldwide electronic communication tools to enhance teaching, learning, scholarship, research, and community service. Today BESTNET is a dynamic, developing organization of people, institutions, tasks and technology.

OBJECTIVES

- Continue to build a distributed, multi-institutional electronic network.
- Use the network to prepare, coordinate and deliver educational materials supporting instruction in numerous disciplines.
- Create and support an electronic community of scholars for collaborative research.
- Provide an international facility for electronic meetings, specialized conferences and other electronic interactions.

FEATURES

DISTRIBUTED NETWORK

BESTNET is designed as a fully distributed, integrated computer conferencing, electronic mail and videotex network for education and research.

ELECTRONIC CLASSROOMS

An electronic classroom uses modern information technology as primary tools for teaching. Today's telecommunications systems make it easy to span borders and cultures. Classes are taught using such media as computer conferencing, electronic mail, videotex, audio, and video; hence, they are not limited to a specific time or place. Students participate when it is convenient for them and their input is immediately made available to all participants of the conference, regardless of their location.

COLLABORATIVE TEACHING

Collaborative teaching involves a variety of arrangements and alliances among universities and colleges and their faculties. Guest experts can participate from anywhere in the world, providing a unique opportunity for students to learn from a wide range of sources. The classroom can be expanded to include several instructors from collaborating institutions.

COLLABORATIVE RESEARCH

A number of scholars and researchers participate in BESTNET conferences. The researcher can establish a conference to discuss a particular problem, present a new idea, or pose a variety of questions. Researchers and students can then reply to topics presented in the conference. Because the respondents are not limited to a particular discipline or area of study, expertise may be enlisted from the humanities, business, the sciences or the social sciences. This gives the researcher a unique opportunity to gather information viewed from several different disciplines and add fresh insight to academic work.

COMPUTER CONFERENCING AND INFORMATION RETRIEVAL

BESTNET participants use computer and communications technology to access one of the several BESTNET nodes via telephone modem, the Internet, or X.25. Digital Equipment Corporation VAX Notes conferencing software, electronic mail, and convenient menu-driven access to information retrieval services are provided on a 24-hour basis. All VAX Notes conferences on all nodes are accessible from any one node and all input to conferences is retained on the various systems so that a documented history of discussions exists.

PRIVATE CONFERENCES

In addition to public forums, private conferences with one or more moderators can be established for groups interested in a confidential electronic "conversational" arena. Conference members from remote areas may participate in meetings, project development, or informal talk in a timely, convenient, and on-going manner. The moderator maintains a membership access list and may chair topic areas.

ELECTRONIC MEETINGS

Conferences can be opened to all or limited to a select group of people. Each conference has one or more moderators who manage the conference. Meetings can be conducted on the computer without the constraints of time or place.

Conferences can have a life of a few days or be of unlimited duration. The moderator can add or delete members and create electronic mail distribution lists.

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Gary Levine
California State University, Dominguez Hills

Vicente Lopez/Rodrigo Gutierrez
Centro de Enseñanza Tecnica y Superior

Duane Metzger
University of California, Irvine

Mark Resmer
Sonoma State University

Art St. George
University of New Mexico

Armando Valdez
Instituto Tecnológico de Mexicali

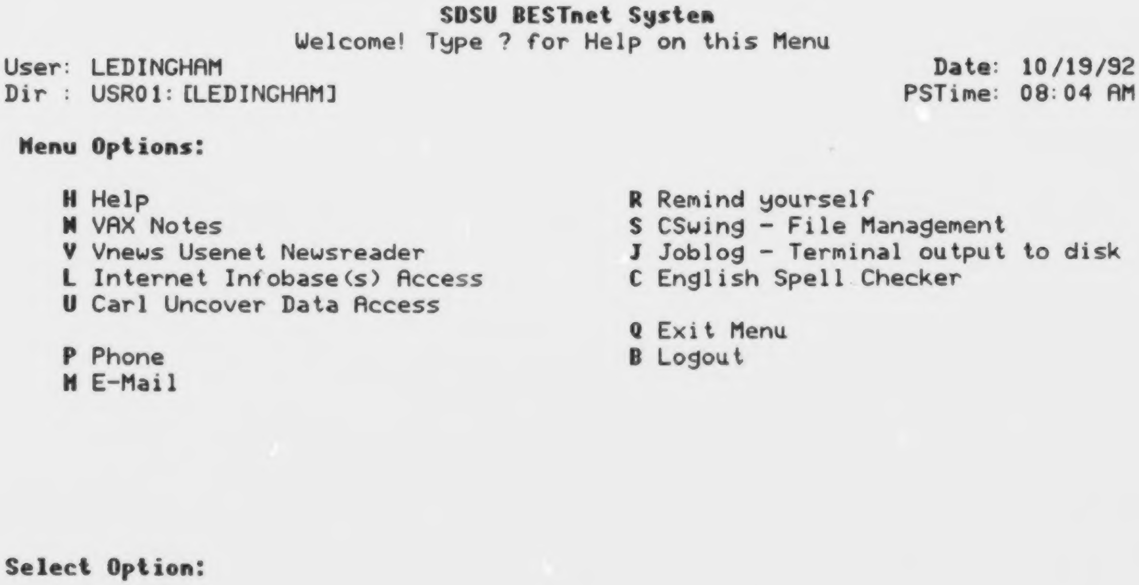
John Witherspoon
San Diego State University

BESTNET CLASSES

More than 50 classes are now being conducted by 9 universities. They include:

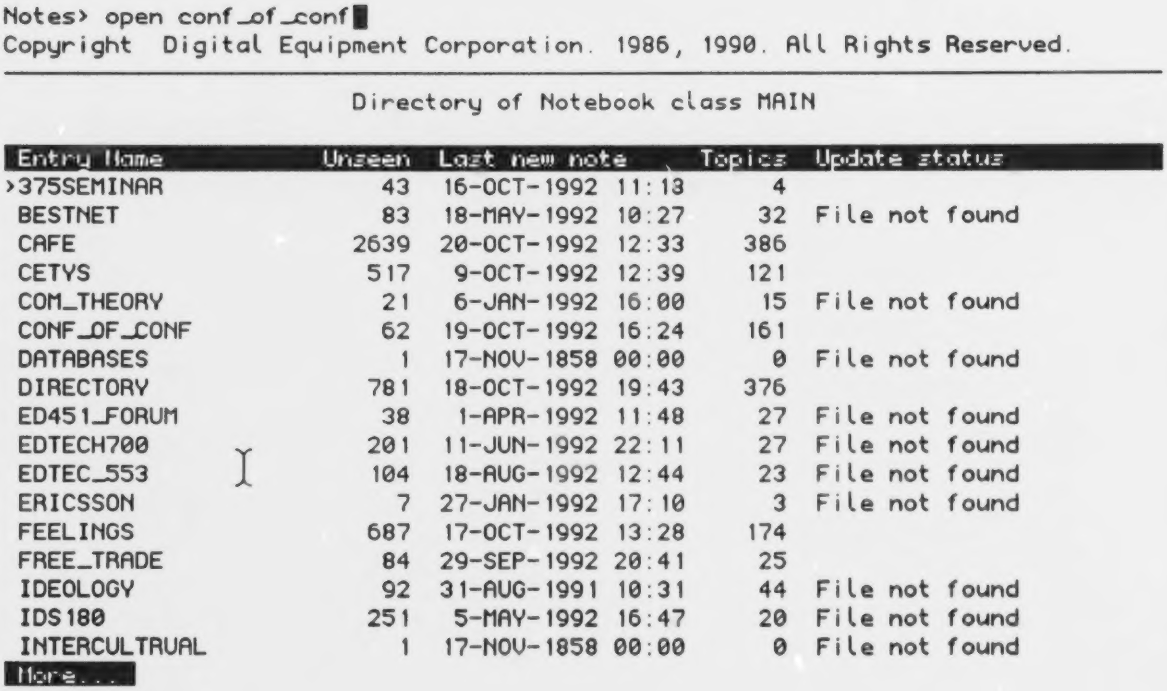
Course	Institution
Technological Trends in Telecommunications	San Diego State University
Mass Communication and Society	San Diego State University
Practicum in Evaluation	San Diego State University
Intercultural Communication	California State University, Los Angeles
Chicano Studies	California State University, Los Angeles, Sonoma State University, Texas A&I
Communication Theory	California State University, Los Angeles, University of Nairobi University of Zimbabwe
Theory and Practice of Long-term Social and Economic Development	University of California, Irvine
Ethnobotany	University of California, Irvine Arizona State University
Introduction to Computers	CETYS, Tijuana Mexico
Psychology and Communication	CETYS, Tijuana Mexico
Speech Processing Chips	Instituto Tecnologico, Mexicali, Mexico
Technology and Society	Texas A&I
Introduction to Sociology	University of New Mexico
Language and Communication Behavior	University of California, Irvine
Script Writing, Mass Media & Human Interaction	California State University, Los Angeles
Organizational Communications	California State University, Los Angeles

SCREEN #1 (MENU)



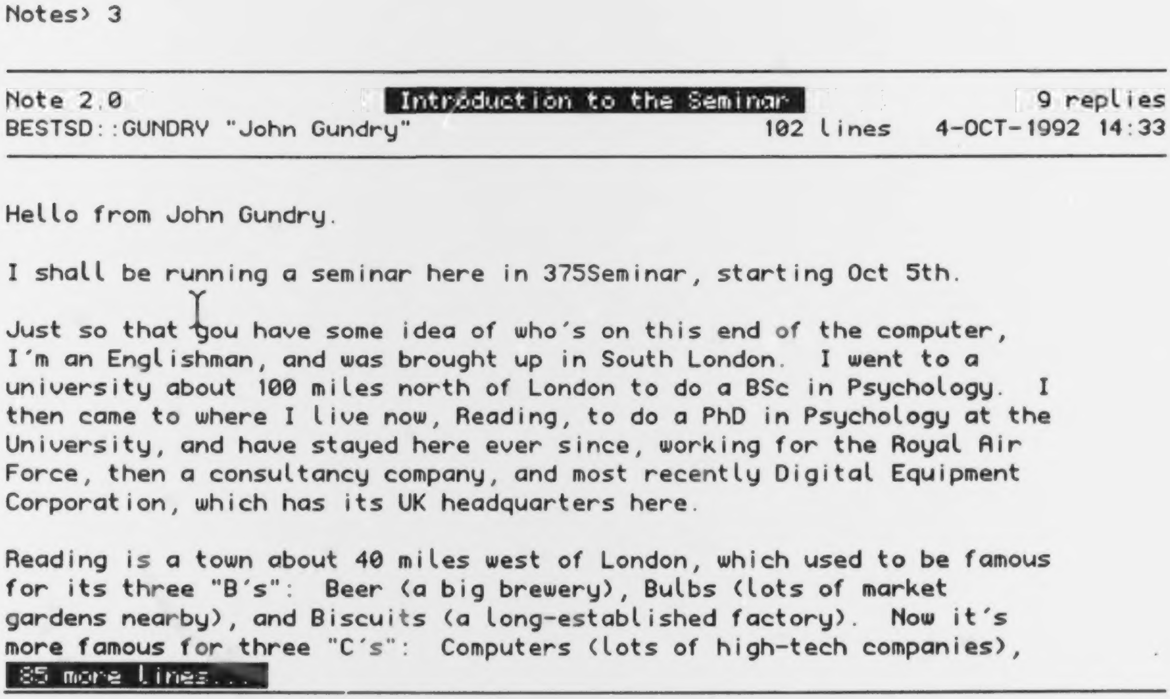
```
                          SDSU BESTnet System
                   Welcome! Type ? for Help on this Menu
User: LEDINGHAM                                            Date: 10/19/92
Dir : USR01:[LEDINGHAM]                                 PSTime: 08:04 AM

 Menu Options:

   H Help                               R Remind yourself
   N VAX Notes                          S CSwing - File Management
   V Vnews Usenet Newsreader            J Joblog - Terminal output to disk
   L Internet Infobase(s) Access        C English Spell Checker
   U Carl Uncover Data Access
                                        Q Exit Menu
   P Phone                              B Logout
   M E-Mail




Select Option:
```

SCREEN #2 (MAIN DIRECTORY)



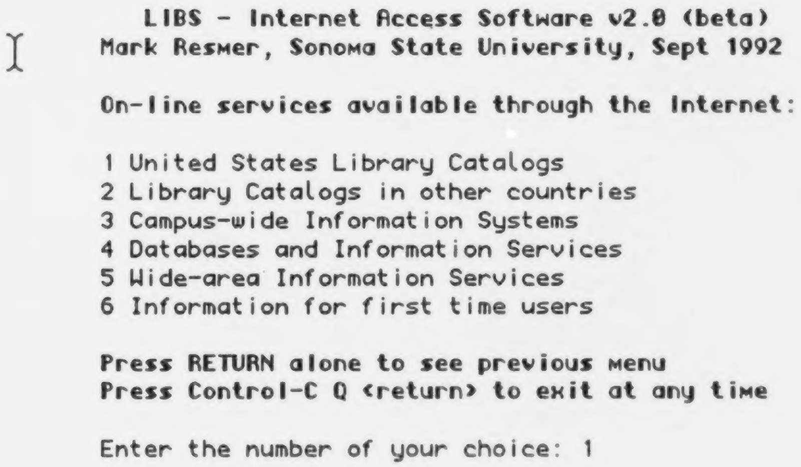
```
Notes> open conf_of_conf
Copyright  Digital Equipment Corporation. 1986, 1990. All Rights Reserved.
--------------------------------------------------------------------------
                      Directory of Notebook class MAIN

 Entry Name            Unseen  Last new note      Topics  Update status
>375SEMINAR               43   16-OCT-1992 11:18      4
 BESTNET                  83   18-MAY-1992 10:27     32   File not found
 CAFE                   2639   20-OCT-1992 12:33    386
 CETYS                   517    9-OCT-1992 12:39    121
 COM_THEORY               21    6-JAN-1992 16:00     15   File not found
 CONF_OF_CONF             62   19-OCT-1992 16:24    161
 DATABASES                 1   17-NOV-1858 00:00      0   File not found
 DIRECTORY               781   18-OCT-1992 19:43    376
 ED451_FORUM              38    1-APR-1992 11:48     27   File not found
 EDTECH700               201   11-JUN-1992 22:11     27   File not found
 EDTEC_553               104   18-AUG-1992 12:44     23   File not found
 ERICSSON                  7   27-JAN-1992 17:10      3   File not found
 FEELINGS                687   17-OCT-1992 13:28    174
 FREE_TRADE               84   29-SEP-1992 20:41     25
 IDEOLOGY                 92   31-AUG-1991 10:31     44   File not found
 IDS180                  251    5-MAY-1992 16:47     20   File not found
 INTERCULTRUAL             1   17-NOV-1858 00:00      0   File not found
More...
```

SCREEN #3 (INTRO TO SEMINAR)



```
Notes> 3

Note 2.0                  Introduction to the Seminar                9 replies
BESTSD::GUNDRY "John Gundry"                       102 lines  4-OCT-1992 14:33

Hello from John Gundry.

I shall be running a seminar here in 375Seminar, starting Oct 5th.

Just so that you have some idea of who's on this end of the computer,
I'm an Englishman, and was brought up in South London.  I went to a
university about 100 miles north of London to do a BSc in Psychology.  I
then came to where I live now, Reading, to do a PhD in Psychology at the
University, and have stayed here ever since, working for the Royal Air
Force, then a consultancy company, and most recently Digital Equipment
Corporation, which has its UK headquarters here.

Reading is a town about 40 miles west of London, which used to be famous
for its three "B's":  Beer (a big brewery), Bulbs (lots of market
gardens nearby), and Biscuits (a long-established factory).  Now it's
more famous for three "C's":  Computers (lots of high-tech companies),
85 more lines...
```

SCREEN #4 (LIBS)



```
   LIBS - Internet Access Software v2.0 (beta)
Mark Resmer, Sonoma State University, Sept 1992

On-line services available through the Internet:

1 United States Library Catalogs
2 Library Catalogs in other countries
3 Campus-wide Information Systems
4 Databases and Information Services
5 Wide-area Information Services
6 Information for first time users

Press RETURN alone to see previous menu
Press Control-C Q <return> to exit at any time

Enter the number of your choice: 1
```

CURRENT ACTIVITIES/PROSPECTS

At the present time (December 1992), the central task of the BESTNET organization remains to fulfill its contractual obligations to Digital Equipment Corporation by conducting research and submitting reports in the following areas of investigation:

- Social Factors in Networked Communication
- Interinstitutional Collaboration
- Networked Learning Processes
- Development of a Human-Network Interface
- BESTNET Backbone Development
- Project Assessment and Evaluation

A number of specific research reports in these general categories have already been completed as originally scheduled.

Another important set of activities involves the development and expansion of BESTNET into other arenas of education and training. Recent examples include:

- Grant support from the Center for International Business Education and Research (a consortium of 23 research institutions) to provide datacommunications and database development services to member institutions

- Grant support from the Public Service Satellite Consortium for the development of telecommunications databases

- Use of BESTNET as a vehicle for a Master of Arts in Humanities external degree program (CSU, Dominguez Hills)

- Prospective installation of BESTNET in selected Maquiladoras in Tijuana (CETYS/SDSU)

- An assortment of smaller, highly-specified projects

Perhaps the most exciting aspect of BESTNET, however, is in the domain of international development. Indeed, the original and continuing involvement with institutions and colleagues in Mexico speaks to this growing BESTNET commitment. Areas of the world that hold the most promising prospects in this regard include Latin America, Eastern Europe and Russia, and Africa. Contacts with individuals/institutions in these regions and others represent vitally important work for BESTNET, and will almost certainly constitute the impetus for the future growth and success of the BESTNET organization.

New Partnerships:
Helping Faculty Integrate Information Technologies in the Curriculum— The Learning Technologies Program*

Carrie E. Regenstein
Cornell University
Ithaca
New York

The Learning Technologies Program (LTP) — sponsored by Cornell Information Technologies (CIT) and Apple Computer, Inc., during the 1991-1992 academic year — was a series of workshops designed to help faculty integrate information technologies into their curriculum. The underlying premise of the LTP was that technology must be presented in the context of faculty's instructional objectives. We are currently pursuing "Train the Trainer" activities to help others be able to offer the LTP curriculum themselves.

This paper discusses issues related to the Learning Technologies Program: its goals, how its participants responded, what we learned, and implications for the management of resources.

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* A modified version of this paper appeared in the EDUCOM '92 Proceedings.

Background

The Learning Technologies Program (LTP) was a series of workshops developed and offered by Cornell Information Technologies as a pilot project sponsored by Apple Computer, Inc., during the 1991-1992 academic year. The goal of the workshops was to help faculty who are technical neophytes to learn to use information technologies to enhance their instructional activities.

The underlying concept of the LTP was that the "instructional computing" support paradigm for faculty had to be modified. We agreed with the notion about faculty expressed recently by David Smallen (Director for Information Technology Services and Institutional Research at Hamilton College): "Making the transition from being a non-user, or an occasional user, to a user in the classroom is nearly impossible unless intermediary steps are taken."[1] The LTP was one such intermediary step.

Since the Learning Technologies Program was driven by instructional goals rather than technical ones, we started by focusing on the specific objectives of each faculty participant. Faculty participants were encouraged to set their own objectives based on some pedagogical challenge they were struggling with, however small, for which technology might offer some solution. A variety of methods was used—with an emphasis on Macintosh hands-on sessions—to offer a palette of technological solutions that would help faculty find the technology more accessible, adaptable and meaningful.

During the 1991-1992 academic year, the LTP served 224 participants from 18 states and two other countries (Canada and Turkey); they represented 43 schools, predominantly two- and four-year teaching institutions. Although the majority of participants came from the northeast, there was increased representation from elsewhere in the country as the year progressed and the LTP became more known. Half the participants were from New York State.

Faculty Participants: what they did and what they said

Faculty were encouraged to attend the workshop with a technical partner from the home institution. Sharing the workshop experience gave the faculty member a "private consultant," a sense of institutional support, and—perhaps most significantly—a greater chance of fulfilling his or her objectives upon the return home.

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[1] David Smallen, "Planning for Information Technology Resources: The Issues," Computing Strategies in Liberal Arts Colleges, Martin D. Ringle, ed., 1992, pp. 3-28.

The three-day event included a variety of activities. Five non-discipline-specific hands-on sessions comprised the core curriculum: Dynamic Lecture Tools, Introduction to HyperCard, Digitizing and Images, Visual Databases (Using Videodisks), and More About HyperCard. The sessions, created by a team of staff, were linked by workshop format and hand-out design; specific examples were also repeated in multiple sessions to offer reinforcement and the "comfort of recognition" for newcomers to technology.

Registration brochures invited participants to "bring their stuff," i.e., to bring the slides, photos, and other classroom treasures they had stashed away over the years—to be integrated into the outline or template solution to be started at Cornell. We came to realize that the LTP's target audience was so new to the use of technology that readers did not understand what kinds of raw materials to bring; they could not imagine the kinds of technological integration we were describing. We therefore adapted this concept into a more defined, guided "project" experience.

Once at Cornell, then, participants were offered suggestions for outlines and templates that could be created to solve the pedagogical problem they had defined in the pre-workshop questionnaire. Specified times were allotted for the partners to work together on these projects with significant consulting help available. The workshop's final session—a "show and tell" of these projects—became a favorite amongst participants. Although the projects were only "beginnings," the participants' enthusiasm and empowerment were clearly in evidence. To maintain the sense of community, and follow-up on the participants' progress at home, we established a newsletter, *LTPnews*, and an on-line mail-list, *LTP-Link*.

Participant feedback stressed three areas of growth. Faculty indicated that they had many more ideas for the possibilities that technology could offer them in instruction. They were more ready to become advocates for technology on their campuses. And, in some cases, they were willing to pursue granting opportunities to continue the work they started at Cornell.

Other participant feedback indicated that the gains were sometimes immediate and unexpected. One faculty member reported that she was able to evaluate a new software program with a far more knowledgeable (and critical) eye. Numerous participants commented on their loss of "technophobia." Many used the words "not intimidated any more," "shortened learning curve," and "empowered.' They expressed plans to actually *do* their projects back at home—and sent their colleagues to the next LTP event. A systematic follow-up with all 1991-1992 participants is in progress at this writing.

What have we learned?

We have learned a great deal offering the Learning Technologies Program. First and foremost, we have a heightened appreciation for the help that faculty need to first start using technology, especially in instruction. When training faculty to use technology in instruction, the line between training and consulting becomes quite fuzzy. (Note, for instance, the tremendous value of the individual projects started by participants.) The process is labor intensive and expensive: if we begin with the assumption that faculty's role on campus does not necessarily include technology, then we recognize that helping faculty take this first step requires the dedication of quality resources.

Each LTP session included exposure to "faculty exemplars:" faculty who had successfully integrated technology into their instructional activities. Not surprisingly, participants responded enthusiastically to their own peers' demonstrations and discussions. We found the lecture-demonstration mode of including these exemplars to be consistently effective, reliable, and cost effective. This session was often followed by spontaneous discussions and brainstorming about possible uses of information technologies in instruction as well as strategies for obtaining necessary resources. Participants reported being very inspired by this component of the program.

The LTP made effective use of participants' feedback: there was an ongoing process of seeking—and responding to—the suggestions of a knowledgeable clientele. In addition, the use of professional evaluators immediately raised the quality of the LTP. Our follow-up with the first evaluators—inviting them back to offer our staff a "methods of teaching" workshop—significantly quickened the pace of the program's refinement.

Where do we go from here?

The LTP seemed to touch an important nerve for faculty. The workshops quickly became oversubscribed. Participants asked permission to reproduce materials to share at home. Numerous callers requested that we travel to their schools to offer the workshops there. At the same time, it seemed more cost effective to find ways to leverage the work we had done and help others be able to offer the LTP curriculum themselves. As a result, we are offering *Train the Trainer* workshops to our counterparts during the LTP's second year.

The first *Train the Trainer* sessions are scheduled as a pre-EDUCOM Conference seminar in October, 1992, and at Cornell in January, 1993. Participants should be those who are charged with training faculty in the use of Macintosh technology—or those whose staff will be charged to do so. The program includes both pedagogical and technical issues.

We are hoping that offering an entire suite of materials and methods for integrated hands-on sessions will provide our counterparts with a significant "kick-off" to their own programs at a manageable cost. Many schools can afford to put together one or two (two-hour) sessions; four or five become too expensive without help. All *Train the Trainer* participants will receive extensive materials (hard copy and electronic: course hand-outs, demonstration files, instructor guides) — with an invitation to modify them for best use in their home institutions. We are also hoping to publish these materials for those who cannot attend any of the *Train the Trainer* sessions planned for the 1992-1993 academic year. We are considering *TTT-Link*: an on-line listserve that would help us share materials and methods with *Train the Trainer* participants.

Teaching faculty to use technology to enhance their instructional activities is labor intensive. In the current economic climate, institutions in higher education must work together to leverage these activities most effectively. We continue to work with the EDUCOM consortium to seek ways of sharing the materials and experience we have to offer, and welcome readers to suggest other forums for dissemination.

CAUSE 92

TRACK VIII

MANAGEMENT CHALLENGES FOR DISTRIBUTED SERVICES

Coordinator: Russell S. Vaught

While central systems tend to be centrally funded and managed, the converse is true for distributed systems. Operating units vary in their willingness to provide adequate funding and support. Papers in this track address the many challenges of distributed services management.

Client/Server Based Data Warehouse at the University of Arizona

Cheryl Bach-Scott
Htay Hla
Michele Singleton
Elizabeth Taylor
Paul Teitelbaum

The University of Arizona
Tucson, Arizona

Abstract

The University of Arizona is implementing a data warehouse on a relational database to be accessed by desktop tools using client/server technology. The warehouse is a repository of data extracted from the "legacy" systems and loaded into a Digital Equipment Corporation's Rdb database. The database contains data from University Student Information, Payroll/Personnel, and Financial Account systems.

This presentation will provide an overview of how information is acquired currently for decision support and other management needs. The client/server model being implemented will be described including the warehouse system configuration and the client desktop tools being used. Management issues related to this project will also be discussed along with the associated data administration activities. The presentation will include a live demonstration of the system if Internet connectivity is available in the presentation area.

The targeted audience is information services personnel at all levels of institutions with basic to intermediate knowledge of relational database and client/server computing.

Tucson, located 50 miles north of the Mexican border in the beautiful southwest, is the home of the University of Arizona. Rich in Spanish, Mexican and American Indian heritage and now populated by a melting pot of people from all over the world, it provides a perfect backdrop for an institution of higher learning.

The University of Arizona campus is large in both acreage and population. The campus covers 339 acres and has over 150 buildings. Serving over 34,000 students each year, the University offers some 150 majors in 12 different colleges. A world leader in astronomy, space science, and systems engineering, the Institution is ranked 19th in the nation for research and development. Last year over 50 National Merit finalists chose to attend last year. Of the 4000 faculty members, 85% have earned doctoral degrees and some are noted Nobel and Pulitzer prize winners. Over 5,000 staff members provide supporting services to this large and diverse campus environment.

The University's computing services are provided by the Center for Computing and Information Technology, commonly referred to as CCIT. Led by the Associate Vice President for Computing and Information Technology, CCIT has four major areas of responsibility: Decision Support, User Support, Telecommunications, and Operations. Each group plays a critical role in supporting the University's administrative systems, but it is the Decision Support analysts and technicians who are responsible for the maintenance and enhancement of the major administrative computing systems. Decision Support is comprised of five groups: Distributed Data Management, Human Resources, Financial Records, Student Information, and Production Services.

Decision Support provides the support for the three major administrative systems: the Student Information System (SIS), the Personnel Services Operating System (PSOS), and the Financial Records System (FRS). The Student Information System provides detailed information about student admissions, financial aid, registration, orientation, transfer evaluation, and billing. The Personnel Services Operating System is responsible for payroll, applicant processing, budget and employee records maintenance. The Financial Records System maintains all accounting, purchasing, accounts payable, accounts receivable, and fixed assets data for the University. Each of these legacy systems is extremely large and contains millions of lines of COBOL code, hundreds of reporting programs, and dozens of screens, combining to provide a support various processes on campus.

The application environment is also very diverse. SIS and FRS reside on an IBM 3090 with SIS data stored in VSAM files and FRS data stored in IDMS/R files. PSOS executes on a PRIME minicomputer with its data in ISAM files. This configuration of multiple hardware platforms and separate, incompatible database management systems complicates the data processing environment and adds a level of difficulty when combining data items that span the systems.

These three administrative computing systems serve a myriad of customers located throughout the large campus. The growing information requirements of these customers are as diverse as the customers themselves. To support their decision making process many of these customers have gained expertise in the report writing tools available to them (e.g., SAS, Z-writer, OLQ, Focus). While these tools satisfy many of their reporting needs, there are many occasions when a customer determines a need for information that they cannot provide for themselves. It is the Decision Support staff that they typically rely on to provide them with this information.

The interaction between the customer and the Decision Support analyst is a paper process known as a Service Request. The Service Request Form allows the customer to identify problems, enhancements, or information requirements. The Service Request is routed to Decision Support where it is assigned to an analyst and then passes through the typical analysis, prioritization, coding, testing, and customer approval steps. The coding, testing, and customer approval phases are often repetitive and time consuming. These phases may include mailing output from analyst to customer and back again or scheduling meetings where the analyst and customer can review the output and determine modifications. Once the customer approves the output and signs the Service Request Completion Form, the job is scheduled and formally documented. Finally, the job can be placed into the production environment. This entire process of gaining information to make a decision can take anywhere from a few hours to several weeks depending on the complexity of the request, the mainframe loads, and the workload of the analysts. Often the lengthy Service Request process results in customers making decisions without information that would be available to them in a more dynamic computing environment.

The combination of the time it takes to complete a Service Request and the increasing information demands by customers has resulted in the Service Request queue stretching far into the future. Additionally, the increasing demand for information has resulted in an increased mainframe workload. The mainframes are rapidly becoming saturated. There are not enough computing cycles available to service all computing needs. This situation still exists today, however, some time ago, CCIT began to explore alternatives in order to provide better computing services. The available options seemed to be either a costly hardware upgrade to the mainframes or moving applications toward a technology which would provide a more dynamic environment by taking advantage of the computing resources residing on the customer's desktops.

Decision Support began pursuing client/server technology as a means of providing the dynamic computing environment that was needed. Client/Server was pursued for several reasons. First, the model would make the most effective use of existing computing resources by cooperatively executing a process or transaction on two or more computers. In addition client/server technology would allow for the migration of computing processes away from the mainframe. The desktop would provide the computing resources for data presentation and manipulation. The resources associated with data management would be provided by a separate machine fine-tuned for that purpose. Finally, the desktop tools would provide a much more friendly interface for the customers, and allow them to have control over their own data needs.

An implementation team was formed and a pilot project to develop a data warehouse utilizing client/server technology was launched. This project was to be a prototype and its primary objectives were to prove the technology and to provide reporting and inquiry access to the data currently housed in the three legacy systems. The project was named the University Information System (UIS).

Early in the project, the UIS implementation team determined that the data warehouse had to be stored in a relational database. The relational model offered many advantages over the older hierarchical and network databases: easier data access, more flexible database design, and changes to a relational database structure could be affected in minutes, as compared to hours or sometimes days for the network or hierarchical models. Lastly, Structured Query Language (SQL), recognized as the standard for accessing relational databases, would provide an effective data access mechanism. Digital's Rdb product was chosen as the relational database and a DEC/VAX-4000 chosen as the UIS server. The Digital Educational Software Library/Campus-wide Software License Grant provided the University with the ability to purchase the software at a significant discount.

The next step in developing the prototype was determining the data elements to reside in the warehouse. The server did not have enough disk storage to duplicate the volume of data in the three administrative systems. To effectively determine which elements to select for populating the new UIS database, an inventory was taken of data elements used to process ad-hoc reports. Any element referenced more than once was selected. Today these selected elements, which represent approximately 20% of the total data elements in the mainframe administrative systems, comprise the UIS database.

With the contents of the data warehouse resolved, the implementation team began experimenting with the many tools available to access the Rdb data warehouse. Today, customers who wish to access the data in the UIS data warehouse may choose from a variety of client tools depending on their needs or familiarity with various products. For example, many of the more popular desktop applications, such as LOTUS or EXCEL, provide add-on tools that allow the application to access data in remote databases. Other tools, such as DATAPRISM and DECQUERY, provide data access to the remote databases and the ability to export query results for use by other data manipulation packages. Thus, a customer can create a query in a familiar desktop environment, ship the query across the network to the UIS server, retrieve the results and manipulate the query results at their desktop. At this point, eight university departments were strategically chosen to become beta users in the use of this prototype.

As it exists today, the data warehouse provides the beta users with timely, accurate data. To achieve this, the appropriate data is extracted from the legacy system databases and then transferred to the UIS machine and loaded into the Rdb database. This process occurs in batch mode with different data being downloaded on varying schedules. For example, SIS student demographic data is propagated weekly, while Financial system transactions are loaded daily, and payroll data is updated after each bi-weekly payroll. In addition to this operational data, metadata is also available. The metadata provides a definition for each data element, a list of the valid values for an element, and the date-time stamp of the last data load for each table.

The UIS data warehouse represents a break from the operational application systems that CCIT has deployed in the past. Traditionally, CCIT develops application systems which perform administrative functions such as registering students, paying employees, and posting financial transaction. UIS, in contrast, does not perform any administrative processes, it provides read-only access to data from the three major administrative systems in a single data warehouse.

With the prototype developed and the client/server tools adequately tested, it became evident that a method for introducing this new technology to the campus community was needed. CCIT knew that acceptance by the campus community would be imperative for a successful implementation of any new technology. Campus departments would have to be sold on the new technology, new ideas, and new ways of doing business. Many people felt that a live demonstration of UIS would put the project in the limelight and generate the most interest. Therefore, a team was established that would be responsible for demonstrating the new technology and the prototype. This team consisted of three application analysts, one from each of the application support groups within Decision Support, along with two members of the original implementation team. All members of "The UIS Demo Team" were very familiar with the user community and understood their concerns and needs.

The demo team began developing the format of the presentation. The team decided that the demonstration to the customers had to be state-of-the-art and could not consist merely of simple overheads. They wanted to use software on a workstation to show the use of technology. Presentation software was evaluated and selected and a software slide show was developed. This slide show consisted of 15 slides which explained in a logical sequence how business was currently done at the University, and why a new way of accessing and sharing information was needed. This was followed by an introduction to the client/server environment, an overview of the UIS prototype, and the benefits derived from implementation of this new technology. Finally, an introduction to the terminology associated with relational databases and client/server technology and a live demonstration accessing the UIS database was provided. The presentation was designed so that each team member participated in the demonstration by discussing a different slide. During the live demonstration, teamwork was again used with one person speaking and another running the software.

The team presentation method proved to be successful for a variety of reasons. First, it made each member more effective by allowing him/her to focus on particular portions of the presentation. Second, shifting the audience attention from one person to another made the presentation more interesting. Third, one or more persons on the team is familiar and respected by the audience. Having familiar and trusted applications analysts has helped build confidence. Finally, the cross-sectional team within Decision Support helps to communicate a joint effort by all three administrative systems groups.

Many people have been involved in the evolution of the presentation. Initially, the team presented to the managers of Decision Support. After this presentation, a critique session was held. This feedback was incorporated, the slide show was modified, and the live presentation was altered. The next group was a peer group presentation within Decision Support. This played a dual role by introducing the 40+ staff members to client/server concepts and allowing them to give feedback to help the team further refine the presentation. Following these presentations, each department in CCIT was given a chance to see the presentation and offer suggestions for improvement. After the CCIT presentations were completed, the team began giving demos outside of CC!T.

The demo has been presented over 30 times with audiences ranging from Vice Presidents and the Provost to Departmental Systems Analysts. Because the audiences are so diverse, the live portion of the demonstration is customized. For example, if the audience was a group of high level administrators, the live demonstration was tailored to answer general University questions such as "What is the undergraduate enrollment by residency and class level?". If the audience was a group of business managers the demonstration might contain a budget report for a particular department.

After each presentation, a question and answer period followed. Often the same issues surfaced. Many of the concerns were anticipated, but required policy changes for the University. For example:

What server should we move to?

Who will pay for the server?

How will we use other servers?

Who pays for Ethernet Connections?

What client software should be purchased?

Who pays for the client software?

What desktop hardware should be purchased?

Who pays for the desktop hardware?

Who will install the Software and Hardware?

Who will provide training on the Software and Hardware?

Who will troubleshoot problems?

Who will provide documentation?

Who will develop queries?

How will the queries be made public?

Who will provide consulting for query development?

Who needs the information?

Should there be data access/security policies?

Who administers the data access/security policies?

Who determines the data to be housed?

Who interprets the data?

Today these issues and concerns are being addressed by several committees and top administrators. In addition, CCIT has formed a new cross-departmental team whose mission is to identify the next steps in fully implementing UIS at the University of Arizona. Inputs and recommendations from these groups will determine the future of client/server computing on our campus and specifically the future of our prototype project. In the meantime, eight beta users continue to use the new prototype to answer their daily business questions. The prototype has been successful in proving the technology, however, it has opened a pandora's box regarding management issues.

THE DECENTRALIZATION OF APPLICATIONS GROUPS AT STANFORD: A FIVE YEAR RETROSPECTIVE

A panel discussion with

Ann Mueller, Manager of Systems for Administrative Resources
Marick Payton, Director, Network for Student Information
Gerry Weitz, Director of IS, School of Medicine
Judith Yarborough, Manager, Financial Information Systems and Services

ABSTRACT

The four panelists have been managers of applications programming at Stanford under the prior centralized organization and during the five years since this function was decentralized into the separate business lines. They will review the history of this organizational change and reflect on its advantages and disadvantages as they have observed them .

Ann Mueller, Manager of Systems for Administrative Resources

Context

In mid-1987, when application programmers separated from the central Information Services organization and were distributed to various business units, our group aligned itself with the administrative services component of the university. The unit which I came to manage ultimately supported systems across multiple vice-presidential areas including Administrative Resources (Procurement, Stores, Housing and Food Services, Conference Office, Environmental Health and Safety), Planning and Management (Facilities Project Management, Operations and Maintenance, Transportation), Human Resources (HR Systems, Salary Management), Finance (Accounts Payable, Reimbursements, Travel), and the Stanford Management Company.

In addition to our interactive, mainframe-based applications, our group provided all development and maintenance support for the inventory management/distribution and EDI systems running on the Stores System 38 and ad hoc support to work order/job cost applications running on Operations and Maintenance's HP9000.

During these years, we aggressively developed "central administrative" systems and associated electronic forms, inquiry, and reporting applications for the use of all university staff engaged in administrative activities. In support of these department-oriented products and services, we provided a variety of user documentation, training classes, and consulting. At the peak of these activities (FY 90/91), our group responded to over 6,000 email and phone consults and conducted 52 training sessions with a total attendance of over 1,200 staff members. And, as the use of electronic forms and services became the preferred way of doing business between departments and central offices, the annual transaction volume generated by departments using our systems went from 65,000 to over 300,000.

Our client-base rapidly shifted from a narrow band of central office "system owners" to a diverse community of over 2,500 people, primarily staff but also faculty and students. We took on new roles as facilitators between central and departmental needs and wants. We learned how to become an advocate for the interests of the departments in their relationship with central administration and how to ameliorate differences between these two constituencies in the process of system, product, and service development.

Staff

At the time of decentralization, seven programmer/analysts an administrative support person, and a one-third time manager were allocated to this group. Over time, our numbers grew to 11 people as we added one programmer/analyst, a full-time manager, and a staff position to work with departments and central offices on the external design and requirements for our departmental applications, to write user documentation, to construct and teach courses, and to provide email and telephone consultation.

Issues

Staffing: In industry, a typical decentralized IS unit is comprised of 50-90 people allowing for a mixture of skills, levels of abilities, and flexibility in resource allocation. Few economies of scale can exist in an IS organization of 10 people and one's ability to leverage resources, either staff or the university's significant investments in systems and information is severely limited.

Although turnover is and has been extremely low by any standard, most people left one unit only to join another decentralized unit or the Data Center, where they perceived a greater opportunity for career growth and/or advancement. Typically, these people were high potential or high performance individuals.

Alignment and Ambiguity: At the highest levels, the organization of the university has changed over the past years while the IS organizational structures have remained relatively static. As new administrative areas emerged, staffed by new senior officers, IS units aligned themselves (for better or for worse) to these new vice-presidential areas. We found ourselves marching to new, and different drummers while long-term, strategic visions for IS grew more and more faint. During this time, especially during senior management transitions, long periods of ambiguity, without global initiative or directive, settled over IS units.

Funding: During the past few years, in pursuit of an aggressive development cycle (six programmers assigned to development and only two to maintenance), our liability to support and maintain the systems we have put into production has grown to enormous proportions.

However, base funding for the ongoing support of these systems had been inadequate or nonexistent. Budget cuts due to repositioning efforts have further eroded our existing base. This remains a major, unresolved issue for most IS units.

Standards: We no longer subscribe to a common set of standards in our use of technology, in the funding and development of systems and services, in the measurement of our work, in the evaluation of our progress, or even in the performance of our staff. Each decentralized IS unit has established its own cultural identity.

New Technology: Many of us believe that the technology (mainframe-based, SPIRES proprietary DBMS) which has served us well over the past 15 years is reaching the end of its productive life cycle. As we look towards a new architecture (micro-based, client/server) to meet the future business and information needs of the university, we recognize that we must acquire a wide variety of new management knowledge and technical skills to be successful and expedient in this transition. Our small, independent IS units (engaged in day-to-day operational activities) do not have the staff, time, money, and perhaps even the necessary skills to initiate a systematic business and/or technology migration.

Conclusion: Change is inevitable and things will no doubt change again. One might speculate why we have been able to accomplish, collectively, as much as we have over the past years. First, we all knew each other and respected each others accomplishments prior to decentralization. Those relationships have served us and the university well. Second, our staffs are dedicated and hard working. Finally, five years ago, at the time of decentralization, we took away with us a well-formed strategic vision about where we wanted to be at this point in time and we have collectively and individually pursued that vision.

Marick Payton, Director, Network for Student Information, Stanford University

A SUCCESS STORY FOR DECENTRALIZATION

Stanford's decentralization of business application programming groups some five years ago--the movement of management authority, budget and bodies from the Data Center to the VP areas--has been very fruitful for the offices of the Vice Provost for Student Affairs (VPSA) and its system group, the Network for Student Information (NSI). Our business area, headed by the Vice Provost for Student Affairs, incorporates the offices of the Dean of Students, Undergraduate Admissions, Financial Aids, the Registrar, Housing and Food Service, Student Health, NSI and several other offices. Total staffing is about 600. NSI developed and maintains a custom, integrated information system to support the functions of these offices. NSI also supports the administration of graduate student admissions, aid and academic progress management by schools and departments and the student accounting functions of the Bursar. NSI has a staff of 19: 12 programmer/ analysts, four operations staff, one trainer/documentation writer, one administrative assistant and a director.

There are a number of consequences of the decentralization of NSI into its client business area that have increased its productivity. The most significant of these are:

- We know our clients and their businesses better. Being co-located, these businesses go on all around us. Our staff support them year-after-year.
- We have a stronger identification with and more allegiance to our clients. Part of this is organizational: We are managed by our client organization. We and they perceive their business to be our business. Part is personal: we associate with our business colleagues day-to-day: in the hallways, the restrooms and staff lounge as well as in their offices.
- We are better able to bring systems expertise to management deliberations at both the VP level and in the individual offices, exercising more influence on strategic planning, work design, hiring decisions, etc. As Director of NSI, I participate with my fellow Directors and Deans in the VP Executive Committee.

These effects are well illustrated by three major projects we have undertaken in the past three years. The first of these was support for the decentralization of graduate student affairs. The parties who made the decision to close the central Graduate Studies Office and decentralize its responsibilities had little understanding of the scale and complexity of the functions involved. Planning, management and time frame for this undertaking were all seriously inadequate. We were given responsibility for developing new computer systems to enable performance of the admissions, aid and degree-progress management by the several hundred staff in academic departments. We committed ourselves, on our own initiative, not only to redesigning all the screens and documentation to make them suitable for use by this large number of inexperienced staff, but also to complete automation of the graduate aid process with interactive linkages to the personnel and accounting systems and incorporating the University's relatively new forms-routing and electronic signature capabilities. This decision to take on a greatly increased work-load (a year of 60-hour work weeks) and considerable additional risk with no additional staffing was made by my staff because they felt their clients needed the efficiency that such a completely automated and integrated system would provide. And, when a long period of uncertainty about who had what policy authority in the new decentralized order left critical functional specifications unresolved, the NSI staff stuck their necks way out and just made the best judgment they could so the system could be functional by the critical deadline. Is this the right way to develop systems? Absolutely not. But, by "busting ass" and "bending rules," we kept a lot of people at the bottom of the ladder from drowning under a tsunami of poor planning and management from those at the top. I believe my staff made these extraordinary commitments because of the special allegiance they have developed to their clients.

More or less concurrent with the University's decision to decentralize graduate student administration, major budget reductions were made for all central administrative offices. In reaction to these cuts, the offices of the Registrar, Housing, Financial Aids and the Bursar decided that they could achieve significant cost savings while improving service to students if NSI could create a system to enable students to do much of their business with the offices through on-line query and update access to their individual database records. This student access system, the second project I will describe, had to be sufficiently intuitive and self-guiding that no training was required, if the budget reductions goals were to be achieved. And, all students had to use the system. This seemed a wonderful opportunity to use the client/server technology under development by our Data Center to enable use of a graphic user interface (GUI) to the mainframe database. We entered into a partnership with the Data Center to do so. Their primary objective in this collaboration was to develop a set of conventions for GUI design that could be used for other applications at Stanford. There was tremendous excitement in both organizations over being involved with this state-of-the-art technology. We spent six months working intensely with the DC on interface design and the client/server architecture before concluding that the risks that all this "new stuff" might not work, let alone work in time, were greater than our clients could afford. We made a wrenching turn of direction and developed the system as a guided, line-by-line interface supported directly on the mainframe. Then, the staff on this project spent the next year working 60, 70 and even 80-hour weeks to make up for lost time. Throughout this development effort the NSI staff and the responsible staff member from the Registrar's Office worked cheek-to-jowl. I credit our recognition–in a timely manner–that our desire to use the technology of the future was creating an unacceptable risk to our clients, in good part, to sensitivities developed as a result of being "one" with them organizationally.

Ditto for the willingness to work far beyond the call of duty. Incidentally, Axess has been a tremendous success.

My last example illustrates the enhanced ability to bring systems expertise to business management which can result from the merger of business systems support into the client business line. We had struggled for years to develop solid automated support for one of our client offices with little success. The problem was primarily that the office lacked any real systems savvy. This problem was compounded by a management culture that fostered guarding knowledge--knowledge as power--rather than sharing it. When an opportunity to hire a new associate director arose, I was able to get myself and my programming manager onto the interview panel. And, when it appeared that the job was going to a candidate whom we felt would bring little relief from the problems of the past, we were able to exercise sufficient influence, on both the VP and the office director, to hire the "second" place candidate, whom we felt would bring great systems strength, as well as open up the management culture. This new associate director and I were able, subsequently, to develop a plan to completely re-engineer the way the office does business and have just secured funding to implement this plan, including extensive system development to support the new way of doing business.

Clearly, there are disadvantages to decentralizing applications groups. Obvious ones are that it makes it harder to develop enterprise-wide strategic planning for IS and to enforce enterprise-wide technical standards; it may make it harder to integrate business systems across business lines; it may limit career paths for technical staff; it may lessen the chance for technical cross-fertilization between systems groups, and it may promote excessive conservativism about taking risks with new technology. My colleagues on this panel will no doubt add to this list. These are serious issues and they must be managed. However, I believe that, in today's business environment, described by Peter Drucker as "turbulent" and by Tom Peters as "chaotic" and exemplified by the examples given above, the advantages outweigh the costs. With business (academic business quite as much as commercial) facing constantly increasing competition, reduced resources, more regulation and demands for more accountability, business needs systems support that brings the business knowledge, involvement with business management, and intense commitment that decentralization of systems support provides. Such systems support can make a major difference as management copes with downsizing, new product and market development, work re-engineering and quality management. A critical success factor in achieving these outcomes is strong leadership and vision from the senior business management.

Gerry Weitz

Organization of IS: A School's Perspective

The question of whether to group business application programmers in a central IS organization or decentralize them into their client business units is interesting, controversial, and, I assert, will not solve the fundamental problems we face in the future. I'd like to look at the problem from another perspective, that of a information systems manager in a school.

Figure 1., below, illustrates the difference between how a school or department views data and process and how the central administrative organizations view data and process.

	Central Administration Vertical Organizations						
School and Department View of Data and Process	Human Resources	Finance	Sponsored Research	Facilities	Health & Safety	Student Resources	Development
Research Administration →	X	X	X	X	X	X	
Faculty Recruitment →	X	X	X	X		X	X
Financial Planning →	X	X	X	X	X	X	X
Space Planning →	X	X	X	X	X	X	X
Curriculum Support →	X			X	X	X	
Faculty Support →	X	X	X	X	X	X	X
Student Support →		X	X	X	X	X	X

Figure 1. A school's view of data and process cuts across the boundaries of central administration's vertical organization.

The IS professionals are focused on serving the central administration and, through the central administration, the academic departments. They are not focused on serving the academic departments directly. Historically this made sense because information technology was too expensive to apply to the data and process problems of small, heterogeneous organizations. That is changing rapidly. We currently have needs in schools and academic departments to do planning and analysis that requires data across multiple central administrative organizations. If the promises of object oriented technology come true, we will be able to tailor processes to fit these small organizational units.

There are three questions I would like to raise to help think about possible future organization for IS professionals.

- Who owns the data?

  In the past the data was "owned" by central administrative units. Even if they were styled as "data custodians" it was still de facto ownership. The responsibilities of ownership include definition, security, audibility, entry, access and storage. This was exercised within the vertical boundaries of the administrative unit with occasional weak integration with data in other administrative lines.

  We now need data that is defined consistently, integrated, secure, and available across the whole institution.

- Who owns the process?

  Information processes were also seen to be owned by central administrative units. Finance owned the payroll process so they picked the system to be used and, if so enlightened, sought buy-in from academic departments and schools. This was really the only practical way to do business in the past. Now, academic departments and schools are building their own processes and need to have influence on the systems that are implemented by central administration.

  When the object oriented technology comes to fruition, will we have the ability to hook processes together like tinkertoys? If so, then the central administrative organization will not be the sole owner of the information systems process; the schools and departments must also have their say.

- Who owns the desktop?

  Historically, the central IS organization has provided the "desktop" as a view into central data and processes. But the desktop has evolved from a timeshare terminal to a independent microprocessor that integrates the data, processes, tools and information for an individual. It give us the ability to individualize our view of the information world. How can a central IS organization understand what is important to a large group of individuals dispersed across the University?

James Wetherbe of the Carlson School of Management, University of Minnesota, in an article "To Centralize or Decentralize," Information Week, September 19, 1988, p. 74, wrote, "There are three factors to consider [to best decide what to centralize and what not to]: interdependency, homogeneity vs. heterogeneity, and corporate culture."

If business operations are highly interdependent, centralization is necessary. If interdependency is low, then if the business operations are homogeneous, centralization would make sense. Corporate culture may override other issues. Wetherbe adds one caveat, "But you should never completely decentralize planning."

Applying this reasoning to the situation at Stanford in conjunction with the questions posed above, I come to the following conclusions:

- Data ownership should be centralized. We are interdependent on consistent, high-quality, available, secure data and should not leave that function to the uncertain administration of individual administrative offices.
- Architecture, Technology, and Business Systems Planning should be centralized. This includes infrastructure standards, technology assessment, approved product lists, business systems data exchange standards, business systems process standards, and human interface standards. Again, this effects everyone and we all, central administration, schools and academic departments, need a voice.
- IS professionals can be decentralized to their client organizations. It will always be important for IS management and professionals to have a close relationship with the people they serve. Their options for information systems, however, must be constrained by centrally enforced standards.

Finally, we have the question of the corporate culture for centralization or decentralization. With a new President, Provost, CFO, VP for Personnel Services, and VP for Student Affairs, it is anyone's guess as to what our corporate culture will be.

Panel Evaluation of Stanford's Five-Year Experiment with Decentralization of Business Systems Development and Maintenance

Judith Yarborough
Stanford University
Stanford, CA

In the early months of 1987, the process of reorganization the Information Technology function at Stanford began. One of the outcomes of that reorganization was the decentralization of the applications programming staff into the line organizations they served.

ADMINISTRATIVE INFORMATION SYSTEMS STAFFING AT STANFORD

CIRCA MAY 1987

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- MEDICAL SCHOOL INFORMATION SERVICES
- FINANCIAL INFORMATION SERVICES

HOSPITAL INFORMATION SERVICES
COMMUNITY INFORMATION RESOURCES
SPIRES CONSORTIUM
DEPARTMENTAL INFORMATION SYSTEMS

First, a look at how Information Technology was organized. Within Administrative Information Services (AIS) there were a director, five Assistant Directors, a Quality Assurance group, and a departmental support group. Under the Assistant Directors, there were nine programmatic areas, five of which focussed on the needs of a single line organization. Where there was a single organizational focus, the Assistant Director had a joint reporting relationship. The relationship made the Assistant Director responsible to both the Director of Administrative Information Services and to the senior administrator in the line organization.

For instance, the Assistant Director for Financial Information Services reported to both the AIS Director and the University Controller, the Assistant Director for Medical School Information Services reported to the AIS Director and the Associate Dean of the Medical School. The line office agreed to pay an annually negotiated amount for a stipulated level of application support services. So for instance, the Controller agreed in advance to pay for a staff of 16 programmers, 1.25 secretarial/clerical help, and an Assistant Director.

AIS also offered application support on a chargeout basis through a group called Business Information Services. This group was designed to offered service to organizations that were too small to warrant an annually negotiated support agreement. Additionally, AIS supported a Community Information program, an interuniversity consortium of SPIRES users, and a group of microcomputer consultants called Departmental Information Services.

Information Technology Services had an advisory group called Administrative Systems Policy and Planning group (ASPPG) that acted as a coordinating body for administrative systems. Under the aegis of ITS and ASPPG, the University had selected a single data base management system, SPIRES (Stanford Public Information REtrieval System), and had promulgated the concept of University-level subject data bases. These two decisions had lead to the development of systems that made administrative information widely available in a common format.

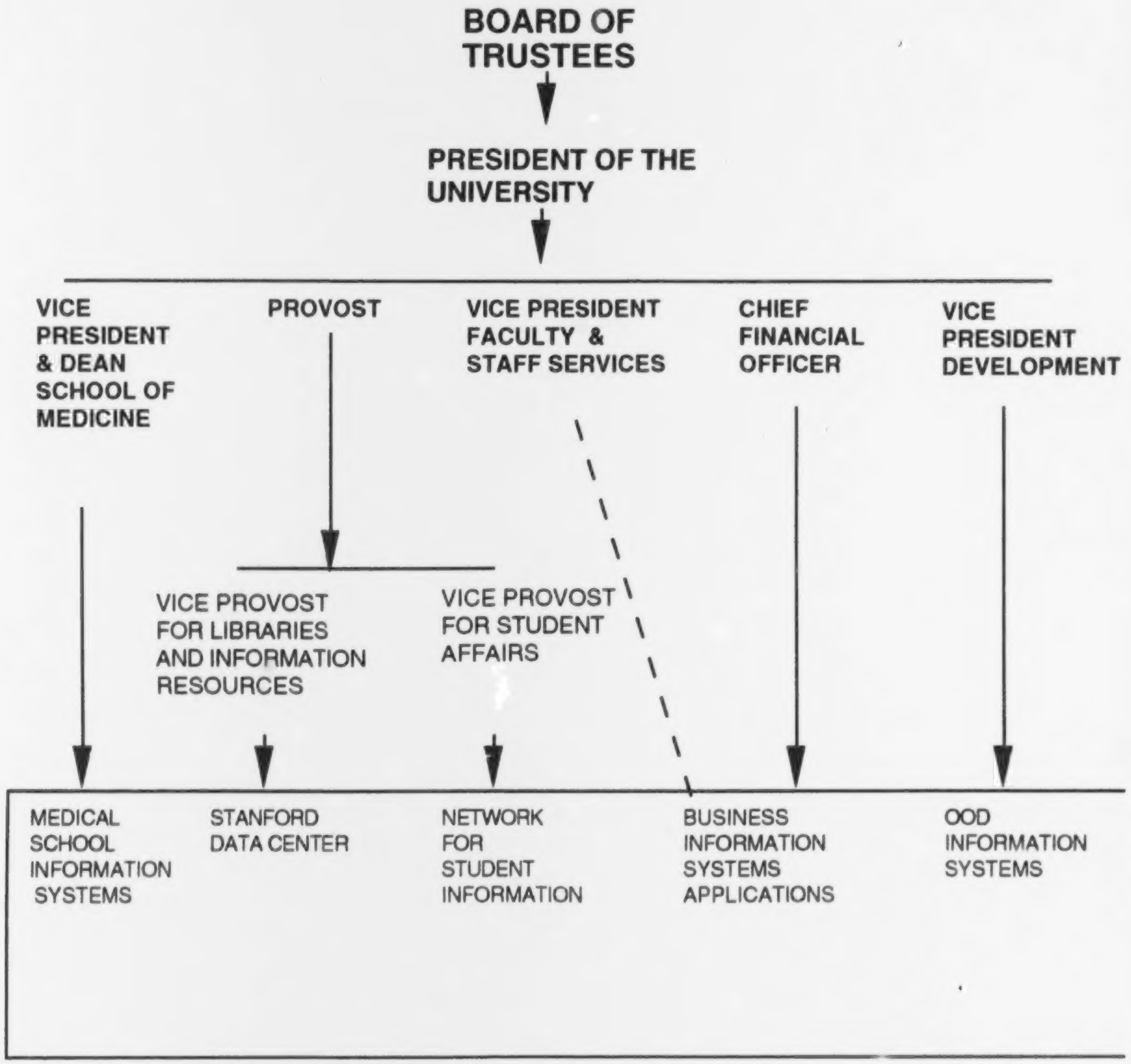
With the creation of a Vice President for Information Resources, a number of changes occurred. Stanford Hospital became responsible for their own applications programming support so the Hospital Information Systems group moved physically and organizationally to the Hospital. Alumni Development Information Services became part of the Office of Development. Student Information Services became part of the Registrar's organization.

Financial Information Services and Business Information Services staffs were reorganized so that one group reported to the VP of Business and Finance through the Controller and another group reported through the Associate Vice President for Administrative Services and Facilities.

Over the past 5 years, there have been a number of change, both within technology units, but also within the University's senior management structure. The result can be seen in the following organization chart. But the basic principle of decentralized application development and maintenance still exists.

ADMINISTRATIVE INFORMATION SYSTEMS STAFFING AT STANFORD

CIRCA NOVEMBER 1992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MEDICAL SCHOOL INFORMATION SYSTEMS
STANFORD DATA CENTER
NETWORK FOR STUDENT INFORMATION
BUSINESS INFORMATION SYSTEMS APPLICATIONS
OOD INFORMATION SYSTEMS

NOTE: CHART COVERS ONLY THOSE AREAS WITH MAJOR ADMINISTRATIVE COMPUTING RESPONSIBILITIES

One further item of interest is that of the technical staff members who were part of the old Administrative Information Services unit, 80% are still at the University in a technical capacity and 57% are still with serving the same line organization unit (i.e. Office of Development, Controller, etc.)

CAUSE '92
Building a Campus Information Culture

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Abstract

Delivering information resources is not merely a technical challenge, but an organizational one as well. An integrated information system benefits all parts of an institution by meeting individual's information needs through an accessible and familiar interface. This paper describes the experiences of the author and his colleagues in augmenting the campus computing culture through the development and deployment of a distributed campus-wide information system.

The Dartmouth College Information System (DCIS) based on a client/server architecture is presently in widespread use across the institution and is experiencing rapid growth. Learning to work with the institution through its individual members and distinct communities of interest has been as important as the technical design and implementation of the system. This analysis of our venture should benefit others pursuing similar goals.

Building a Campus Information Culture

Computing at Dartmouth

The model of computing at Dartmouth was established by the pioneering work of John Kemeny and Tom Kurtz. Dr. Kemeny believed that computing services should follow the example of the library, that is, service is provided as a public utility. At Dartmouth, computing is centrally funded and provided at little or no charge to all members of the community. Services are aimed at reaching everyone in the institution.

In the days of the Dartmouth College Time Sharing System (DCTS), BASIC was the common language of computer discourse and sharing computer programs was easy. Although use of DCTS is coming to a close, everyone on campus is still *automatically* given an account on DCTS when they join the Dartmouth community as faculty, staff, or students. The expectation was and still is that everyone is encouraged to use the services. The standard account has been replaced by an entry in the Dartmouth Name Directory (DND), a database of all students, faculty and staff. A DND entry provides your electronic mailbox and is your identity in DCIS.

Computing services have been planned by a central computing organization with much input from the entire campus. The basic services have been centrally developed and maintained. This has minimized duplication of effort and reduced inter-operability problems in order to maximize the extent to which individuals are able to interact easily with each other. By building on this common foundation, the different departments have been able to pursue their varying interests more directly. They have in many cases developed for themselves a wealth of beneficial applications. Special computing offices in engineering, the humanities, and the social sciences develop applications targeted to their respective disciplines. Computing technology is readily available and can easily be applied wherever appropriate in all disciplines.

The Network

The Dartmouth network has its beginnings in DCTS. Terminals were provided in increasingly remote locations from the computer center. In the effort to support large numbers of simultaneous users on a relatively modest central computer, the network engineers distributed processing power in front of the main system. These devices evolved into the present system of network routers located in the building wiring hubs. The system terminals acquired additional Z80 microprocessor boards to support interactive editing.

Currently all dormitory rooms, offices, and meeting rooms have network ports (explaining the motto "a port for every pillow"). The wiring is mostly unshielded twisted pair. Each building is a zone on a very large AppleTalk network. The building hubs are connected by an Ethernet. A second Ethernet interconnects the current collection of mini/mainframe computers. Additional Ethernet segments connect workstations in the computing center, the computer science department and the engineering school. Ethernet links are now starting to replace selected desktop connections to some of the more than 6,000 Macintosh computers in use.

Network Services

Using personal computers in place of the DCTS intelligent terminals was a natural next step. The idea to select a standard personal computer for the entire campus grew out of the desire to maintain the ease of data and program interchange that was a primary feature of DCTS. In 1983 when this was being planned, the finalists in the system selection were the IBM PCjr, the DEC Rainbow, and the Apple Macintosh 128K. The Macintosh was chosen to be the standard. This decision has obviously had a significant impact on the current state of computing services.

The introduction of the Macintosh was accompanied by the local development of network services. The first project was a network stream protocol and a terminal emulator to replace the DCTS intelligent terminals. In a relatively short time (1986), public file servers, public laser printing, and Macintosh-based electronic mail became available to everyone. These network services support the daily use of about 4,500 students, 825 faculty, 2000 staff members and about 5000 people at the Dartmouth Hitchcock Medical Center. The internal implementations change but the original services are still available. For example the electronic mail server was originally hosted on DCTS and today runs on a network of UNIX workstations.

Compatibility with older ways of doing things is always considered when introducing a new service. The electronic mail system offers an interesting example. The default mail destination is paper, that is, it may be printed and distributed through the campus mail system. Users of the electronic mail system are thereby guaranteed that they can communicate with everyone on campus, though at varying speeds. Individuals not using electronic mail may find out about it in this way; they receive slightly unusual-looking memos in their campus paper mail boxes.

Adoption of standards has simplified providing breadth of service. Software developers can concentrate on a single platform knowing the entire community will be able to use their product, a significant advantage. This narrower focus provides the opportunity to pursue greater depth of service. Instead of investing effort in providing duplicate services on multiple platforms, services can attain greater sophistication and attention to detail.

The emphasis of Dartmouth computing remains on creating services that everyone on campus can and will use. New services start as demonstration projects but they are designed and developed to the point of universal availability. DCIS is the next step in this evolutionary process. While the first network services, like mail, are content free, DCIS development has concentrated on providing access to actively collected, content-laden information resources. The network infrastructure is a essential base on which to build a system like DCIS.

Need for an Information System

The utility of a campus-wide information system can be seen in every department and office. In the academic departments, the use of electronic information sources in research has grown rapidly. Researchers routinely pursue electronic sources on the global Internet. Through the Internet they can communicate easily with their peers regardless of their physical locations. Increasingly widespread electronic information access is providing an immense collection of valuable resources available from one's desktop workstation.

Every administrative office has both information they need to manage their operation, and information to share with the community. Each office faces the need to accomplish these tasks with greater accuracy, more efficiently, with less cost.

Consumers of the information want to use it easily and in conjunction with their other computer tools. For them the computing technology must remain a secondary consideration, a tool in their work and not the focus of their efforts.

DCIS Project Organization

The DCIS project is a joint development of the central computing organization and the library. It was apparent in the initial-stages that such a partnership was natural and essential. The library and computing services each supply critical skills in making the project possible and successful. Co-principal investigators oversee the operation of the project. Developing this service centrally eliminated much duplication of effort. In practice the team is so small it is essential to collaborate.

The Dartmouth library, like Computing Services, has been a leader in the development and use of information technology. Development of an electronic card catalog began in 1979. The entire collection has been cataloged for many years. The physical card catalog has been closed since June 1991. Some new branches of the library never had a card catalog. Material acquisitions and circulation are automated and integrated with the catalog. Daily operations are heavily dependent on these systems.

In the DCIS partnership, the library functions as a central clearinghouse for the selection, acquisition, and maintenance of electronic reference resources. The library staff provide content expertise and are advanced users of the information services in their everyday jobs. They also have frequent contact with the students and faculty using these services and provide important insights and feedback to the software developers.

The computing center installs, operates, and maintains the central database servers. It provides the physical network and the logical data transport between clients and servers.

The DCIS team are the information system software developers. An array of software clients and servers have been developed to deliver a variety of information. Development team members also act as consultants and intermediaries for other departments seeking to develop their own information resources for campus-wide delivery.

Documentation and training have been joint projects of both the central computing organization and the public services of the library. The Dartmouth community has served as subjects in the experiment and in return has gained access to many new tools and resources.

DCIS Objectives

DCIS is designed to address a number of interrelated objectives. The most obvious objective is to simplify access to information. The software tries to eliminate as many manual steps as possible from the process of locating and using electronic information resources. For example, DCIS makes connecting to a database as simple as pointing and clicking. Each step in lowering the barrier to entry has brought more members of the community into daily use of these resources.

It also seemed obvious that access could be greatly improved by harnessing the power of the personal computers available, using them as more than terminals to the mainframe systems. Local processing power has been harnessed in a client-server design that provides more functionality with less user tedium. More sophisticated presentation has been developed than was previously possible. Faster response to requests is being provided with fewer server resources.

The ability to leverage individuals' existing knowledge of the Macintosh's standard program interface is an important goal. The DCIS system fits in with other Macintosh productivity applications. Skills learned in one generally apply to others. Data interchange between different applications is greatly enhanced. For example, collecting citations and formatting a bibliography for a paper are very easy. The viewer formats them and they can be copied and pasted right into your paper.

The ability to deal with many resources through the same user interface is another important objective. The information retrieval programs or "viewers" are able to access a number of functionally different servers in a manner almost transparent to the user. These different sources of information do have similar content.

For example both bibliographic and full text resources can be accessed through the same viewer. Another viewer supporting statistical functions has been written for numeric databases. The effort invested in learning to use one of these viewer applications benefits the user many times on many different databases.

Another objective was to help users find out what resources are available. To answer the question "what's out there?" a system-wide directory pulls together resources from all around the campus. Users can search and browse through the resource collection, similar to the on-line catalog, helping them to discover useful electronic information sources.

We wanted to help users locate, acquire, and maintain the necessary client software on their workstations. It is often frustrating and difficult to keep up with the latest versions of so many application programs. DCIS provides a mechanism to update its components as it is developed. Users learn about updates to the software as they use it, with the system delivering the new version automatically if desired. In this way, new versions have propagated quickly through the community.

Finally, the system is designed to be very modular and yet provide an integrated feel and operation as much as possible. Many standard Macintosh applications can be used as a viewer. In this way, we have been able to incorporate previously existing systems. This is as essential as providing new ones. This design also provides an minimally disruptive upgrade path as various parts change.

Current State of DCIS Project

The DCIS project has been in development about 3 years, starting in earnest in January 1990. The first applications were publicly available on the campus network in April 1991. The software has been distributed to all members of two incoming classes (1995 and 1996) as their Macintoshes were delivered. The library staff is now switching their daily usage from the earlier library system, as DCIS has equaled and exceeded the earlier system's capabilities. Well into the second year of production use, we are trying to cope with substantial growth in usage and demand for more information resources.

Over 50 local databases and hundreds of external sources of information are reachable by the system. Five central computers running about a dozen different servers currently provide information services to hundreds of daily users. The distribution of the servers on a number of different computer systems allows us to add capacity incrementally with no user-visible system changes. Six new client applications have been developed and several preexisting ones have been integrated into DCIS.

The DCIS Navigator application and its system-wide directory server provide a central point of contact with a wide variety of resources. This directory is a way to "advertise" the contents of the system and automates connecting to a resource. It also provides the software delivery and update features.

The Online Library application provides sophisticated search and retrieval capabilities to the collection of bibliographies and full texts. Complex searches, local manipulation, caching, and graphical display of results are among its features. The CLASS application provides a similar function for numerical databases. An image viewer has been developed to display illustrations and photographs.

Several protocol-translating gateway servers are also available. They provide access to WAIS and Z39.50 services at other campuses and businesses using the same DCIS Online Library application.

Collection Development

The project started with scholarly electronic data databases at the library, primarily the on-line catalog, indexes to minor special collections, and bibliographies listing journal articles. A number of electronic general reference works have been added including an encyclopedia, dictionaries, and full texts of standard works. These sources have tended to be highly structured, read-only works with infrequent updates. They were selected because of their broad use and previous development work.

The directory of resources was then expanded to include existing sources of information available on campus life, such as bulletin boards for events, jobs, housing, and network news. Some of these resources were and are still accessed through terminal emulation, although DCIS has eliminated several steps in using them. These sources have tended to be less structured, read-only works with frequent updates. Improved interfaces for more of these resources are being planned.

Using the same terminal emulation approach, selected resources provided by other institutions have been added to the DCIS directory. This makes them more accessible, although each supplies its own unique user interface which makes using a lot of them complicated.

As news of the system spreads, a variety of administrative offices have been suggesting and developing new resources. The success of such projects are essential to broaden interest and increase usage of the system. Time and again we have seen someone's casual interest ("that's pretty neat") change to active involvement ("where can I get a copy?") when a resource of personal interest to them is made available.

Plans are now being developed to incorporate personnel and financial systems into the mix. These sources bring with them a number of complex problems. For example, access control must often be implemented down to the level of specific fields in the database. On-line update of the data, while simultaneously supporting searching, is very desirable if not essential.

Local Information Resource Development

As mentioned earlier, most administrative offices have information to share with the community, and DCIS has provided a new, more powerful method of providing that service. To assist offices in developing an information resource, the DCIS team usually arranges a discussion meeting to understand the resource and its audience. The data content and its size generally determines the complexity of the project and its update needs. Insight into the office's existing process and work flow are often helpful in determining an approach. We try to involve the office in evaluating possible solutions from the tools available, highlighting the differences and tradeoffs.

The DCIS team helps to set up the initial system. The prototype is made available on a limited basis, feedback is gathered and used to refine the implementation. Finally we bring the system up in the DCIS directory and public servers, and hand off update control of the information to the originating office. We usually then mount an announcement effort to bring the new resource to the attention of the appropriate community of interest.

Developing some of these projects has illustrated to us how important it is to distribute the maintenance of the information sources. Unlike the central software development, if the originating office cannot largely maintain its own information resources, the information system developers will be consumed by maintenance tasks.

Experiences with Deployment

We have used a "ripple-out" strategy in deploying the new systems. We have sought to identify and utilize early adopters in a department or office. Developing such an "insider" relationship can be a valuable asset. The early adopter often becomes a product champion, distributing information and channeling back other feedback. Individuals in the work group tend to be influenced more by someone in their existing group than by the DCIS development team.

It is important to draw experimental users into the process at the proper time. The system under development must be stable and powerful enough to be used for real work at this stage. It must provide equivalent facility when competing with an existing system. It is important to watch out for missing features that people have taken for granted and then realize they miss. To make the most of the opportunity, we are reactive to the tester's feedback and follow up on complaints and requests quickly. Gradually, more people are added to the group of testers as refinements are implemented. Finally, a public announcement is made through all available channels.

The switch over period is especially important. It is essential to support overlapping dual systems for some period time. The dual systems have been a problem for the staff; they needed to know both methods for some time and to accommodate various special needs. Substantial functional reasons to switch to DCIS have generally been available and these help to overcome a user's natural reluctance to change a routine.

To assist the adoption of a new system, we have tried to recognize and address the variety of individual approaches to learning and the computer abilities of persons in the community of interest. Training and documentation attempt to support the range of those who "jump in" and experiment (the early adopters), those who like to read about how the whole thing works as they try it, and those who need a demonstration of it before they'll begin to use it. In response, we have provided on-line help in each application, printed extensive user guides, and run "minicourses" and hands-on training workshops.

The Macintosh interface has enabled individuals already used to the Macintosh to use the system with less instruction and training than earlier mainframe systems. Part of this effect is generational. The students are more likely simply to try the software, and they manage to get useful results. Of course, new students have not invested time in learning the previous system. The faculty and staff require more assistance and need to make comparisons against the previous system.

Conclusions

We think the DCIS project has been quite successful. A number of similar systems have been in development for longer periods of time and others have been released and subsequently withdrawn. We think one of the keys to this success is to stress performance and quality in the software. At the beginning, we had to trade these against quick results. Performance and quality allow others to use the software as a tool in the performance of their "real" jobs. The use of "industrial strength" tools and design techniques, especially object-oriented programming technology, has leveraged our development efforts in a very visible way. By being able to draw from a collection of reusable components, our progress has accelerated. Common components help provide underlying levels of common features that look and act the same in different applications.

DCIS is designed to change incrementally as it is developed. This allows great flexibility in integrating preexisting resources. A large number of resources have been assembled in a short time.

In some ways, our strategy to implement a "seamless feel" with separate components has worked too well. New users have been confused about which application they were interacting with. Their mental model sometimes does not keep up with where the system led them.

The advantage of having a "standard" workstation has been substantial. It has been difficult enough to account for the variety of models and software versions in one line of development. DCIS software is starting to influence equipment purchases. Workstation performance became noticeable to those who had entry-level models with some deciding to upgrade. People now ask for equipment recommendations because they want to have a workstation that can take best advantage of DCIS. At the same time, moving much of the computation to the workstation has allowed the same central computer to serve more people than before. But the library's central computer has also been upgraded to keep up with increased demand.

The client/server nature of DCIS can make the system appear more responsive during some high usage times. Since the client workstation is handling operations like keyboard input and scrolling instead of having the server interacting with a terminal, users don't notice slightly longer pauses at times they normally wait for a few seconds.

Spreading the news is still a significant problem. Certain pockets of the campus are still not aware of what is available. Providing a new resource for a particular community of interest has been the most successful way to add new users. Word of mouth has been the next most effective device. Printed and electronic publications (that is, newsletters and electronic bulletins) tend to reach the same group of regular readers.

By working closely with the various organizations that have information to distribute, we have tried to ensure a stable base on which many more resources can be provided. The partnership we have assembled seems to provide an efficient way to develop and maintain such an information system. As people have started to use what is available we have received many requests for other resources.

Users of DCIS have reported enhanced productivity in teaching and research. The electronic mailbox we setup to collect bug reports and suggestions has received a number of complimentary notes. The most apparent effect has been large increases in the number of people using the system. Usage has more than doubled from summer to fall in 1992.

Building a campus information culture is an evolutionary process. Each individual approaches the use of information technology a little differently. By lowering the barriers to entry by several more steps and by trying to cater to a wide variety of experiences and needs, DCIS has been a significant step forward in library and computing services at Dartmouth College.

Distributed Data Management:

People Processes That Build in Quality

Lore A. Balkan, Gerry W. McLaughlin, and Richard D. Howard

"And what is the new corporation? It's the open, networked enterprise of professionals working together in multidisciplinary teams that cut across traditional organizational boundaries and that are externally focused on the customer. The model is based on commitment rather than the military's model of command and control"

----Don Tapscott, author of *Paradigm Shift.* (1992, McGraw-Hill Inc., New York)

Introduction

This paper explores the human roles in developing quality information and how they drive the data processes of our organizations. A model for a three component data environment is presented, making sense of what can easily become chaos caused by rapid change. This model, based on operational, centralized and distributed functions, acknowledges that it is the people who use data, rather than the technology, that truly determines the quality of our information support. Distributed data management must become as obvious a concept as is distributed data use. Data users intuitively know this, but typically do not know how to execute good data management. A framework is presented for understanding data management roles at all levels of an organization. In addition, strategies are discussed for educating and involving people in an ongoing process for gauging and continually improving the quality and availability of information.

Positioning for Constant Change

As competition for resources and customers becomes more intense in a tight economy, greater efficiency and better service are important goals for every business and institution. Many organizations have embarked on business process redesign in order to realize the greatest net gain. In turn, our information systems must adjust and attempt to deliver consolidated information from disparate, stand-alone applications not previously integrated. As management must respond quickly to change, they require data that can provide relevant current and longitudinal information from both internal and external sources. Accurate assessment of a situation is necessary to justify and formulate plans for change. Trend data is critical for planning and goal setting. Self-assessment data is necessary for measuring productivity gains. In addition to supporting analysis that blends data from the past and the present and anticipates the future, the data architecture must allow expansion and addition of functions over time. It must also be an architecture that can be readily transported to a variety of platforms and take advantage of increasingly more effective technology as it becomes available. Organizations with a data architecture that is flexible and responsive to innovation are positioned to take full advantage of opportunities to improve efficiency. They will earn the confidence and support necessary to survive and prosper. Simply put, an organization that is not expandable and adaptable is likely to be expendable. The organization's data architecture is key to its expandability.

The Customer Driven Data Architecture

"Architectures should be "stolen", not reinvented....to the extent that data architectures are stable over time within a company, they should also be quite similar across companies within an industry."

----Goodhue, Kirsch, Quillard, Wybo, *Strategic Data Planning: Lessons From the Field*, **MIS Quarterly**, March 1992, p.25.

In every imaginable scenario where a decision is made; information is provided to support that decision. There are suppliers of this information; there are producers who handle, analyze, and transform data to information; and there are customers who use this information. The producers, or information workers, must refine the data and add value or they will be bypassed. If users, or perspective customers, choose to go directly to suppliers of raw data and attempt to integrate it into information on an ad hoc basis, the results will be inconsistent at best and more likely, inaccurate. Users who make poor decisions for whatever reason, including poor information, will ultimately be replaced.

Often the customer who receives quality information will, in turn, pass it on in some form to another information customer, thus becoming a supplier. Several customers may use the same supplier for similar information while other customers use different suppliers. The likelihood of successful interaction among these customers may well be determined by the compatibility of the information they each receive and respectively use. When the receipt and use of poor quality data negatively impacts the efficiency and service of a function, steps must be taken to address the problem. These steps always influence and change the enterprise's data architecture. The options for change can be categorized as follows:

- **Masking:** Ignore or massage discrepancies or insufficiencies, thus allowing a weak data architecture to prevail and suffering the consequences of continuing to manage with poor quality information.
- **Coping:** Develop local or personal systems in response to unmet information needs, creating a spiderweb data architecture that fails to adequately support either local or enterprise wide information requirements.
- **Correcting:** Demand quality data from the enterprise's systems and accept responsibility for stabilizing and strengthening the data architecture for the enterprise as a whole.

Today's managers understand the challenges of an evolving data architecture, perhaps better than the traditional computer systems professional. Not only have the managers endured the unpleasant experience of receiving multiple and incompatible answers from their major information systems, they have also created their own nightmares. In their local or personal computing environments, they may have failed to maintain sufficiently granular data in terms of frequency of capture or level of summarization. Though few would admit it, most have also found it difficult to use data they have captured because of inadequate documentation. Additionally, these managers have struggled with data discrepancies for years while the organization's programmers cranked out code to process whatever data existed and considered their job successfully complete if the program ran without generating error messages.

Those who manage a function or organizational event have a vested interest in the productivity of the support processes; they are stake-holders. Their success is determined by (1) how accurately they identify the customer and the customer's needs; (2) how effectively they meet the customer's needs; and finally, (3) how convincingly they are able to measure their success and apply what they learn to further improve the process. While this view of success anticipates change, it also has a foundation of stability based on a data architecture that provides a point-in-time quality baseline...or a standard. The standard is really an outgrowth of information producers identifying and responding to customer needs.

Data Management in an Architected Environment

"The new paradigm enables us to break free of the old decentralization/centralization pendulum swing and allow us to use highly dispersed decision-making"

----Don Tapscott from *Paradigm Shift*, **InformationWeek**, October 5, 1992, p.40.

The premise of this paper is that data architectures are evolving to a combination of decentralized, centralized, and distributed information support environments. In the decentralized environment, a spiderweb of systems evolve where data is passed from operational source systems to a variety of users or customers, who then develop their own systems and more than likely become suppliers to subsequent customers. Often these operational systems in a decentralize environment are capable of producing reliable information through their own documentation and definitions. However, they are not an organizational resource because their components are not integrated or standardized. With a centralized system, there are standards in place for data handling and coding and the provision of information. This centralized function adds the interpretability to the data, referred to as the internal validity. The needs of the operational decision makers, those making the daily and weekly decisions, must ultimately be factored into the process. With the mature data architecture, distributed data management, information is distributed to users with enterprise wide content and form to support tactical decision making in a strategic and coherent fashion. This ability to generalize data and information to specific functional issues is referred to as the external validity.

In the managed or distributed environment, the data flows from the operational source systems through a central store, the administrative university data base, where it is restructured. Information then flows out to users from the administrative university data base. This central store contains the critical enterprise data in a standardized form. This means that the source systems must likewise maintain and process standardized data and migrate data to the central store by a flow through a rigid translation process. This translation process is possible only if there is organizational accountability for the following data quality standards (Balkan, McLaughlin, and Harper, 1992):

- Activities to assure proper edit and on-going completeness and accuracy;
- A single official source of critical entities with the list of standard values for key attributes;
- Standardized data descriptions, definitions, and documentation;
- Procedures to retain and successfully use historical data;
- Query capability for users to identify appropriate data sources and procedures to address specific information needs; and,
- Ready access to timely and properly secured data by trained users.

The establishment of an on-going process for managing standardized data in terms of edit, validation, update, alteration, audit, correction, and distribution is data management. For these processes to assure data quality, all stake-holders (suppliers, producers, and the customers) must be involved at different points in data management. It requires (1) the operational offices supply reliable data; (2) the central administrative function integrate and refine the data into the usable form and produce internally consistent information; and, (3) the customer has access and training such that they can generalize the information they receive to their needs and situation.

Nurturing A Commitment to Data Management

"The critical issue is not one of tools and systems, but involvement in the quality efforts of the business units."
----Alan Radding, *Quality is Job #1*, **Datamation**, October 1, 1992, p. 100.

With a data architecture blueprint for quality information support and an organizational mapping that identifies the data management roles at every level of the architecture, it becomes clearer where and how to work the organization to increase awareness and involvement in distributed data management. Furthermore, if quality is basically conformance to requirements, then the nurturing process must begin with consensus building activities to identify the information support requirements. With information support, as with any service, it is always much easier to understand when the service is poor, than when it is good. It is not surprising, and should not be viewed as a negative, that the starting point for improving quality is to create focus on the problems. Many projects and many problems have convinced us that the key issues are not technology issues or resource issues, they are people issues or people related issues such as policies and procedures. In this section, some of the people barriers in distributed data management are discussed. Individuals and groups which are key in overcoming these barriers are also identified. Finally, a basic group process that involves people in addressing problems and formulating change strategies to resolve the problems is reviewed.

People Working Through Change

It has been said, "nothing changes if nothing changes". Improvements require change. As shown in Figure 1, there are three models for understanding the people processes related to making improvements that require change. The first model frames the people process in terms of the PLAN, DO, CHECK, and ACT continuous improvement components. In the PLAN component, we collect people viewpoints and based on this, determine problem areas, their scope, possible causes, and alternative solutions. In the DO stage, prototype solutions are implemented and the results are shared. This is the stage where change begins to occur. In the CHECK stage, the results of prototype change are measured against the anticipated result or against a baseline of "this is what we had before" to determine the effect of the change. In the ACT stage, the desired change is integrated into the way things are being done and the improvement change cycle repeats itself.

Individuals also go through a series of phases as the PDCA change for improvement cycle occurs. The model for the response of an individual to change is the Kubler-Ross sequence for grieving, i.e., denial, hostility, bargaining, depression, and acceptance. This model is pertinent because it recognizes that change is first and foremost the loss of the "way we have always done it", and it is always traumatic because comfort zones are threatened. The first stage is denial. As the PLAN emerges, their is a disbelief of the presence of a problem. The next step, often associated with the realization that the DO is producing something which is different, is one of hostility...most likely aimed at the problem, the change agent, or both. With the CHECK phase, there is invariably bargaining where expedient solutions are weighed against lasting solutions. When there is finally a realization that the old ways are dead and the new must be embraced, people are often overwhelmed and experience depression. However, as they step out, learn the new way, and realize they have influence, depression is replaced with acceptance. Acceptance is further fortified as improvement becomes obvious.

Just as the individual must pass through stages, there is some indication that a group goes through a similar process when confronted with change. M. Scott Peck, in his book **The Different Drum - Community Making and Peace**, discusses four stages that a group goes through before it operates as a team with commitment to improvement, or a "true community". These stages are pseudocommunity, chaos, emptiness, and then community. In the development of a new central mission or purpose, the group will first act as though it is already at the desired point. This is pseudocommunity or false community. The group is not working together but feels it can avoid change if it seems to "get along" and avoids differences, conflict, and confrontation. Since there are always differences, the group will eventually move into the chaotic phase where there is a great deal of turmoil as individuals experience and express hostility toward those proposing the new and the different. Here there will be well-intentioned attempts to obliterate differences by offering simple cures. Bargaining will ensue. In the third phase, the group admits there are new options and there is emptiness as the group lets go of the old and collectively begins to seek out the new. There are feelings of depression with the realization that real change is required and that tweeking the old will probably not resolve the problems. In the final phase, the group becomes a true functioning group or community as the individuals become accepting of new ways doing things and actually gather great energy from the shared experience of confronting issues and finding solutions.

These are, of course, not principals or laws of individual or group behavior. However, they do seem to reflect the way many of us and our groups respond to change. They are important to consider since they clearly indicate that change and improvement are difficult and that no small amount of resolve and patience are needed to enact a real change for improvement.

We can speed the naturally occurring stages of change by understanding five process categories that always impact the nature of the change and making sure all five receive attention. (Geller, 1989):

1. Awareness and education: Those who are to be influenced must be given a sound reason for the change. This will hasten the acceptance of change. Awareness and education occurs best in small groups and should include interactive demonstrations and discussions. Without the interaction, it is much less likely that a change in behavior will occur. This is the step by which the change agent begins the process of change.
2. Verbal and written messages: These messages can be effective, particularly if they propose convenient actions, are precise in what is desired, can be substituted for what is undesirable, are given in the presence of what is requested, and are given in polite language. This is often a predominate occurrence in the PLAN step, as people start expressing their views of the problems and the need to change.
3. Modeling and demonstrations: Role models and examples always clarify thinking. It is essential to prototype what is to occur. This can include examples of specific behaviors appropriate for specific situations. This is the DO step, which tries out the way that seems to be a good alternative.

4. Commitment and goal setting: Personal desire on the part of everyone impacted by change is key to successful outcomes. Obtaining individuals' participation in goal setting promotes personal investment in the outcomes and increases the likelihood that the required changed behaviors will accompany functional change. This approach also paves the way for the people with the most insight to CHECK to see if the prototype is actually a successful alternative to the "old way".
5. Engineering and design strategies: Once positions have been established, it is important to modify situations so it is easier for individuals to do the things which are desired. This amounts to integrating the new way of doing things into the system and is the ACT. Quantifiable measures to reference serve as visible proof of progress and also establish a new baseline to reference for planning the next incremental improvement.

Three Tiers of Data Management

The process of creating quality information starts with the supplier in the decentralized operational office. Here there are two sets of responsibilities we associate with a data custodian and a data steward. The data custodian is responsible for providing relevant administrative data to the organization in a reliable form and in a manner consistent with established standards. The custodian is also accountable for the proper care of the data in the operational system and is directly involved in matters of policy. A data steward is responsible for the maintenance and dissemination of data under the direction of a data custodian. A steward executes procedures which insure the capture, storage, validation, correction, modification, security, documentation, and delivery of data from the operational area.

At the central level, there is a function which concerns itself with enterprise-wide administration of the information resource. This includes activities such as the development and implementation of standards for compatibility, accessibility, and interfaces. It exists to provide information to users from a variety of decentralized operational systems and to further insure that the user who obtains data is also passed an understanding of what the data elements are and how they were collected. This central data management function may also have a responsibility of data base administration if the various operational systems are on the same platform under the same data base management system.

Beyond assimilating and integrating data from decentralized operational systems, this central function is also the logical place for information workers to perform analysis, summarization, and archival of data critical for an institution's decision making. This process of producing information is basically one of pre-processing data and transforming it into information. Performing such transformation of data and producing information will invariably require these information workers to also function as a mediator between the data supplier and the customer/user.

If information is to be provided to various users in a full distributed model, then the central function must take on yet another role. It must be involved in selecting and optimizing technological tools that increase the portability and accessibility of both data and data about data. As a follow-on, this central function must market the products made available and train on their use. The result is that the users or customers will do increasingly more data analysis and interpretation. To this end, the central function must provide the required coordination and education. Furthermore, the central function needs to bring custodians and stewards together with users to increase awareness of users' information needs.

The final tier, that of distributed data management, was alluded to earlier. It is important to realize that very few of those users who receive data and support from the central function are truly end-users because they too have customers. Most of them take the data or information and further distill and combine it through their own analysis and manipulation procedures. As such, they perform multiple roles of user of centrally supplied information and producer of additional data with value added. They may also become suppliers of new operational data to the central function. Their most critical need is to understand the generalizations of the data. Not only how the facts can be interpreted, but also for what purposes. This is particularly important in the context that these users are often in "discovery mode", clarifying their questions as they better understand the data.

Groups That Support Data Management

The individuals in the three tiered data management scheme are those who have needs, wants, and responsibilities consistent with the five processes for behavioral change already discussed. They are the foundation for the compliment of groups needed to achieve the correct balance of change across the organization. Note that these groups will include users and not just supplier and producer personnel. There will also be instances where one person may be a member of multiple groups. There are at least seven generic groups that must be engaged in a program to change and improve data quality and likewise, to sustain distributed data management:

1. Management Group: These are executive administrators who must be advised of progress and major steps undertaken to improve information quality. They should not be expected to be wildly excited about the data management process. However, they will be very concerned about data consistency and accuracy and excited about using the same data as everyone else.
2. Custodial Group: These are the senior managers who need to be brought together to discuss policies, to do strategic management of the data resource, and to discuss issues with the senior personnel in the management group.
3. Stewardship Group: Theses are supervisors and system support analysts for the operational source systems of the organization. This group has a set of responsibilities that are very likely embodied in numerous job descriptions. They translate policy into practice and as a group, should be encouraged to consider procedures which produce standardized data.
4. Central Data Management Group: This group provides the stimulus for identifying the need for change. It coordinates the interfaces between the operational level and the users, thereby establishing position to recommend standards. It also collaborates with the computer technology function on implementing the tools needed for data management.
5. Focus Group: This is a vertical slice of the custodian, steward, operational personnel, users, and other interested individuals who work with data from a major operational source system. This group starts the development of standards for the data in an area and then maintains and activity with audits for sufficiency and relevance. Subgroups are sometimes formed to address specific problem areas.
6. Administrative Systems Users Group: This is an open group of users, stewards, systems analysts, and operational personnel from across the enterprise. It meets monthly on topics such as new processes, changes in technology, developments in systems, and the like. Smaller task-groups are formed from the larger diverse group to work on developing the standards that must cut across the entire organization.
7. Systems Group: This is the work-group or project team that defines, develops, and deploys the underlying systems and networking infrastructure for the organization. A subset of this group is usually assigned to specifically support each of the major operational systems.

In order to instill good data management values at all levels of the data architecture, it is necessary to use all of these teams to create linkages between the variety of organizational perspective. This is best accomplished using functional deployment, or the application of the skills of many individuals to problems. Collective intelligence always enhances problem analysis but even more so when it is represents varying viewpoints.

Putting Groups to Work

"Coming together is beginning. Keeping together is progress. Working together is success."
-----Henry Ford

The authors have worked recently with a basic group process for starting projects to address information quality issues. Each of the five process categories that impact change are incorporated. By hitting on all five categories, a group works through denial with minimal hostility and arrives at a broad based commitment to action. This speeds up and sometimes even accomplishes the setting of an agenda for the next several months of a project...the critical start up phase.

Every information quality issue must be examined from at least three viewpoints: that of the supplier, the producer, and the customer....all who are also stake-holders. Each of these viewpoints has implications for the data architecture. When applied to a functional area where inadequate information support is compromising productivity, the differing viewpoints are embodied in analysts, programmers, clerks, clients, directors, and high-level management. By bringing these diverse people together in a focus group, creativity is quickly brought to bear on problem solving because the perspective of each is broadened and new logic must be applied. Furthermore, the groups diversity allows pre-conceived notions of other perspectives to be either validated or put aside.

To kick-off group interaction, an opening exercise is used to familiarize participants with each other and their respective concerns. It is helpful to also have a key individual in the organization share a vision of the future since the group will need to arrive at a shared definition of what success will look like and how they will know it when it is achieve it, i.e., how it will be measured. Participants start their work by contributing ideas about "success" and then use a voting technique to close in on one definition. This is followed by a discussion of the current situation and the boundaries of the problem or situation. Next, each individual identifies three or four issues they see as limiting success. Teams are formed to group similar issues and eliminate redundancy. The team then proceeds to determine the interrelationships between the issue groups by looking at which ones seem to cause which other ones. An analysis of these relationships will usually show one more highly related than others, and very likely it is a "root cause". This becomes the key concern. At this point, the teams report back and the group brainstorms about next steps whereby problem solving options began to emerge. Another option is to continue the smaller team-work on the key concern by analyzing it in terms of its components. It is helpful to present a model of components such as the data management Tool-kit which forces consideration of the PEOPLE doing ACTIVITIES with TOOLS that access DATA. (Balkan, McLaughlin, Harper, 1992).

"New ideas are fragile, no matter how brilliant or prophetic they are. Like good red wine, they need to breathe." (Wurman, 1990). The use of exercises such as affinity grouping of issues, diagrams of flows, and brainstorming of issues and possible solutions tend to remove emphasis on personalities and give all the players involved breathing room. Thus, energy is brought to bear on discovery of new ways to solve problems. The progression of exercises also demonstrates the PDCA cycle whereby (1) consensus is built regarding the issue (PLAN); (2) work begins with analysis of the issues (DO); (3) the accuracy of this analysis is verified by looking at the cause and effect relationships between the issues (CHECK), and finally, (4) this knowledge is methodically applied using the Tool-kit (ACT). The use of the PDCA gives a balance of task and interpersonal activity to make systematic progress toward quality.

Clearly the group facilitators must provide training segments interspersed with the exercises to turn attention toward data management concepts, as well as to explain the relevance of the exercises to initiating a change process. Quite possibly the personnel best equipped to facilitate are from the central data management function where there is more likelihood that the totality of the evolving data architecture is best understood. The facilitators' tasks also include providing assistance with making the connections between quality issues and the standards that are the latch-pin for assuring that change is truly a lasting improvement. Facilitators also document the group's findings and report back to the group. This reverifies for the group that new knowledge has surfaced and specific action is the next order of business.

Once the concerns are visible and commitment to quality improvement acknowledged, smaller cross-functional teams can be used to develop prototype solutions and products. The make-up of these cross-functional teams should include representation from all the stake-holders with an interest in the outcome, e.g., Management Group, Custodial Group, Stewardship Group, Central Data Management Group, Administrative Systems Users Group, and the Systems Group. Furthermore, periodic progress reports should be brought back to all of these constituent groups as well as to the larger focus group.

Lessons Learned

"The organizations that will truly excel in the future will be the organizations that discover how to tap people's commitment and capacity to learn at all levels of the organization."
--Peter Senge

The following are lessons worth sharing with those that commit to engaging people in the critical organizational task of distributed data management.

- Some non-performers will begin to perform as they are motivated by recognition of their unique expertise, opportunities to take on different tasks in the more fluid organization, and challenges to think creatively and take risks.
- Those unwilling or unable to deal with change may leave or relocate within the organization when their worn rhetoric and claims that "this is the way we have always done it" are challenged and/or ignored.
- New leaders will emerge from those who are flexible, those who are committed and determined, those who nurture growth and learning, and those who communicate a vision for the future. The new leaders will operate more like professional workers offering their own particular skills and less like managers governing.
- As a result of mapping individual skill sets and knowledge of the business to the tasks at hand, roles will swap with some non-technicians moving into more technical endeavors and some technicians taking on management responsibilities.
- All progress is a result of change, first in thinking and then in behavior. Understanding that all change is a step-by-step process can ease the trauma. Anytime we clarify where we are in relation to where we've been and where we are going, we are less fearful and therefore willing to step out of the comfort zone of the familiar and participate in transformation. The required courage is also significantly fortified by joining with a team and not walking alone on the shifting sand.
- Training is essential to survive. People want to work smarter and deliver a valued product. To do this, they need to constantly upgrade their skill-set. This happens only when someone in the organization understands that the future of the organization rests with people, not technological tools, and is therefore willing to invest accordingly. This means offering a compliment of training covering everything from new technology tools to how to manage projects, how to work on teams, and how the mission and purpose of the institution is changing. Knowledge builds confidence and confident people will step out, deal with change, and work for continuous improvement.
- It is important to have a recognized organizational function directly involved with managing the distribution of data to the users. This function must coordinate data management at all levels of the organization and assist users with the resulting products. It may also be responsible for the more traditional data administration functions of custodian support, standards administration, and information systems planning. Another possible role is to provide a technical support bridge between users and the computer technology function. However, this new organization should not become involved in managing technology. It should remain attentive to managing information and as such, may logically affiliate with any one of several existing central university functions depending largely on where users currently seek and find answers to their information requests.
- The enemy of continual gradual improvement is burnout and consequently a loss of enthusiasm on the part of all involved. To avoid burnout, celebrate little victories. It is also helpful if work-groups initiate communication about expectations and personal goals and then work toward mutually beneficial outcomes. Always take time to assess progress and help others understand that every improvement is a success.

A Look Ahead

"Management layers that were set up to report rather than produce are beginning to disappear......More and more managers are spending time outside the hierarchy, working in ad hoc groups formed to solve specific problems..."

> ----Walter Wriston, excerpts from **The Twilight of Sovereignty**, in *The Steamroller of Progress*, **InformationWeek**, October 26, 1992, p.36.

"The roles of the middle level manager will change from communicator of knowledge up and down the hierarchy and controller of clerical staff to that of planner and doer."

> ----Karin Steinbrenner, *Knowledge-based Reengineering*, **CAUSE/EFFECT**, Summer 1992, p. 47.

We have no alternative to the involvement of people in the changes of the future. The people and their relationships in the organization must change as many of our processes are re-engineered to take advantage of new technology and quality management concepts. We must recognize and seize opportunities to create focus on improving data management as part of this evolution. The most difficult part of nurturing quality data management is not in what we do but in how we do it. Resistance in terms of the "way-we-have-always-done-it" can most successfully be addressed if permanent organizational changes evolve out of the various temporary problem-solving groups. In time we may learn to live with temporary organizations, but for now, new structures that acknowledge and support coordinated data management across the three tiers is better than pretending that the old ways can continue to serve us.

Self knowledge and understanding of others helps us cope with change and assist other's through the change process. An understanding of the roles and functions of individuals and groups in effecting change can ease and speed the processes that will create data quality awareness at all levels of the organization. We must relentlessly work for incremental improvements and share the lessons we learn with our colleagues who face similar challenges. Our world is increasingly becoming smaller and cooperative moves towards standards is the norm. We must willingly participate on a multitude of teams, both inside and outside of our respective organizations, to assure that the inevitable changes are positive for all stake-holders and likewise, that they serve us as individuals. In the words of R. Buckminster Fuller: "When I am working on a problem I never think about beauty. I think only how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong."

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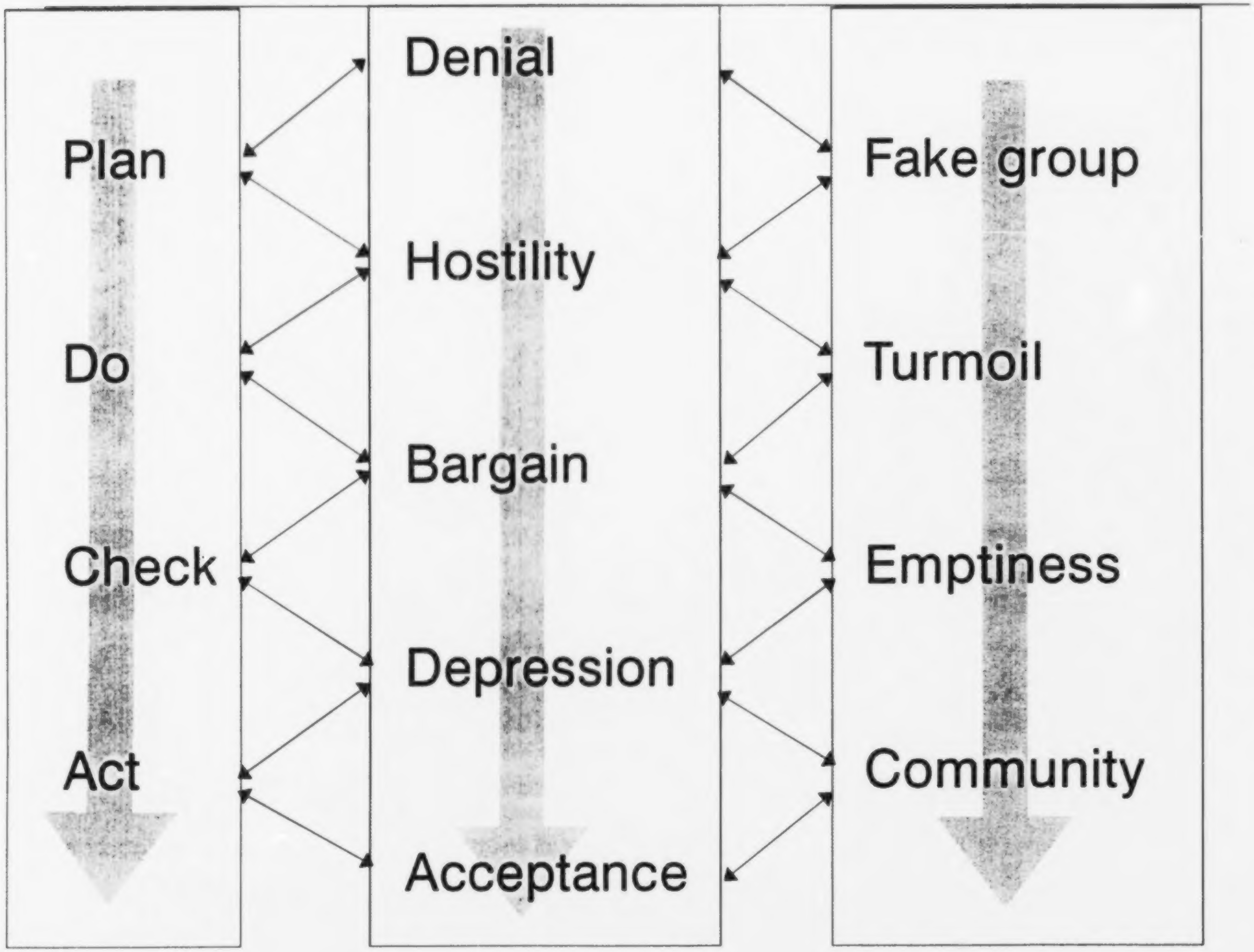
Change



Change Process

- Plan
- Do
- Check
- Act

Individuals

- Denial
- Hostility
- Bargain
- Depression
- Acceptance

Groups

- Fake group
- Turmoil
- Emptiness
- Community

Understanding The Changing Forces In Information Technology

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ABSTRACT

Many schools are decentralizing management authority. There is a clear trend away from institutional decision making and toward departmental authority. Implicit in this new management model is the need for distributed access to information. With distributed access comes the need for new computing models. How fast are the changes occurring? Will major applications be downsized? And, what about "open" systems and client-server computing... What impact are they having on IT in higher education?

This paper will examine several of the changing IT forces currently affecting higher education. The data is derived from our 1991 and 1992 surveys of higher education.

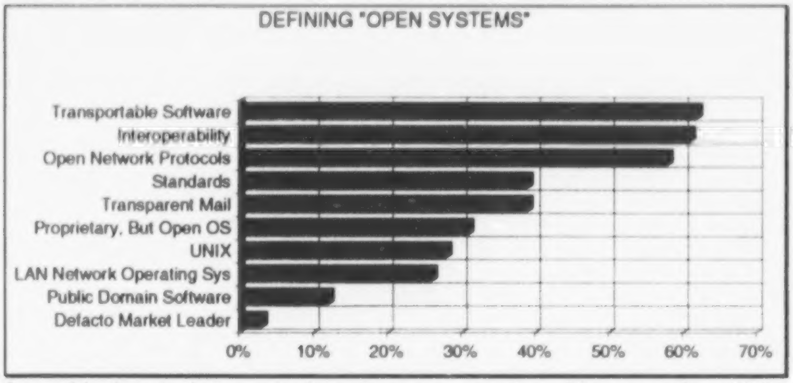
INTRODUCTION

Our 1991 and 1992 Studies entitled Understanding Information Systems in Higher Education reported the results of extensive surveys into many aspects of IT on the campus. While it is not possible, in this short paper, to summarize two 200-page reports, we will discuss several key aspects of interest to both educators and technologists.

The data is taken from the actual survey responses and is augmented by comments obtained by interviewing many notable trendsetters in higher education. We begin by looking at changes to the computing paradigm.

COMPUTING PARADIGM

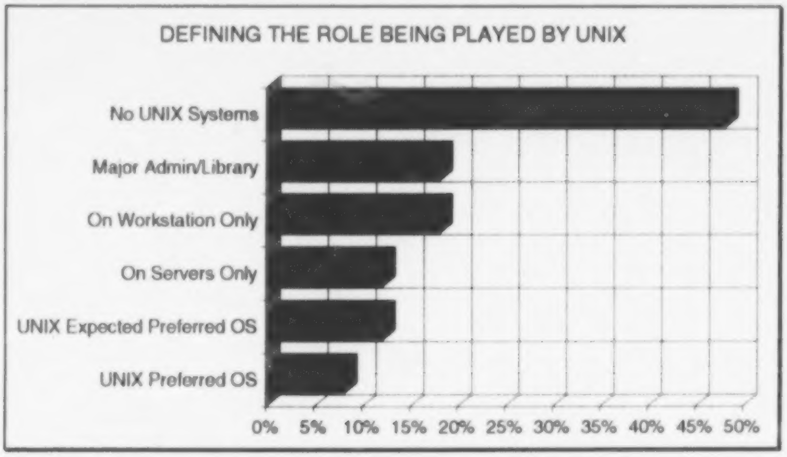
It seems that everyone is talking about changes to the computing model... Open systems and client-server architectures: what do these terms mean to institutions and how fast will the changes occur? Let's look at how our respondents answered some of these key questions.



According to our respondents, we see that *"open" really means freedom of movement -- across platforms and across networks.* Transportable software, interoperability and open network protocols were the most frequently mentioned responses. But, perhaps the most telling insight from this data is that no single answer was mentioned by more than 62% of the respondents. Does this mean that over one-third of the respondents *do not* believe that transportable software and interoperability are determinants of "open systems?" The format of this question was not restrictive. Respondents could have selected *all* options... but they did not. Why? Instinctively we all know the answer. The overall IT industry has not yet -- and may never -- achieve consensus on this topic. Leaving the users with only one choice: to define "open systems" within their own unique, contextual framework.

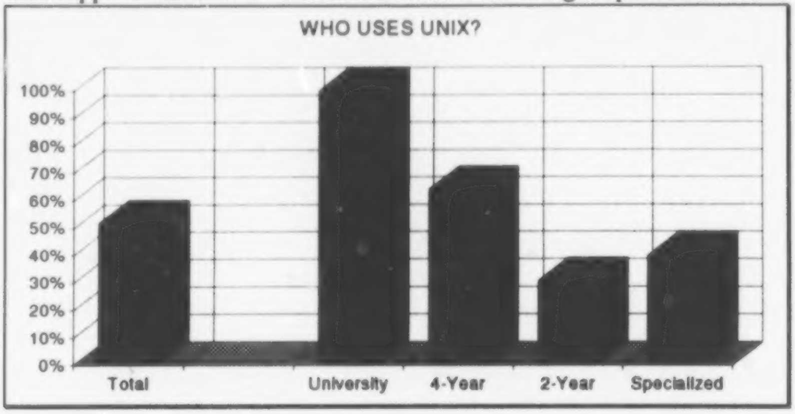
UNIX: MYTH VERSUS REALITY

Assuming that our respondent base reasonably represents the higher education universe, then it appears that "UNIX Power" has grown more slowly than expected. Forty-eight percent of the respondents reported that they had no systems whose operating environment was UNIX... *This means that there are likely to be as many institutions that do not have UNIX systems as there are those who do!* Further, for those that do have UNIX on campus, it often fills a specialized role. Twelve percent reported UNIX on servers only and another eighteen percent only on workstations. Further, only eight percent currently see UNIX as a (as opposed to the) preferred operating system.



WHO USES UNIX?

One would expect to see marked differences in the use of UNIX across the Carnegie classes, and our data supports that thesis. Universities have a much higher penetration of UNIX than others. With 100% UNIX penetration, Universities are clearly leading the march toward UNIX. Four-Year schools are next in line, with almost two-thirds reporting a UNIX presence, and are followed by Specialized institutions. Two-Year schools -- with only 30% UNIX penetration -- appear to have the lowest adoption rate.



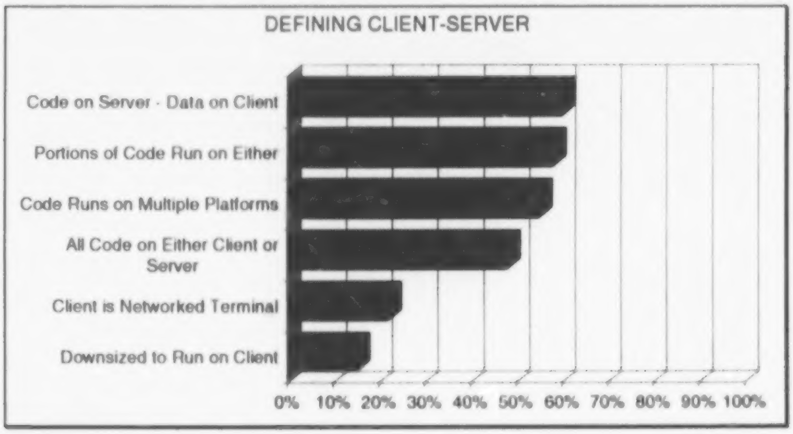
While UNIX does not have broad-based penetration, it does appear to have won the confidence of those who have embraced it. Eighteen percent of respondents said they had a installed a major (mainframe or minicomputer) Administrative or Library system whose operating environment was UNIX. *That's a major commitment.* The reasons for their decision shed still more light on the role being played by UNIX. In a related question, we asked why they purchased a UNIX system. Sixty-five percent replied: the application ran on UNIX; and over forty percent mentioned price/performance of the total solution.

In contrast, only eighteen percent mentioned an institution-wide commitment to UNIX. It does appear that UNIX-based Administrative and Library system decisions are driven more by local decision makers "betting" on the total solution -- and less by institutions "betting" on UNIX.

Examining the flip-side of this coin, we asked those who had *not* installed a major UNIX-based system: "why not?" Fully half mentioned incompatibility with existing systems, and nearly an equal number felt they lacked in-house UNIX expertise. Further, the data does not suggest that schools are avoiding UNIX because they lack faith in the operating system. Common trade press complaints like security issues and inadequate development tools were mentioned infrequently. Rather, it is the need to fit into the current legacy systems and the lack of resources that seem to represent the foremost obstacles. It does appear that if schools believed that a variety of quality applications existed, and that they were compatible with existing systems, the rate of UNIX adoption might be very different.

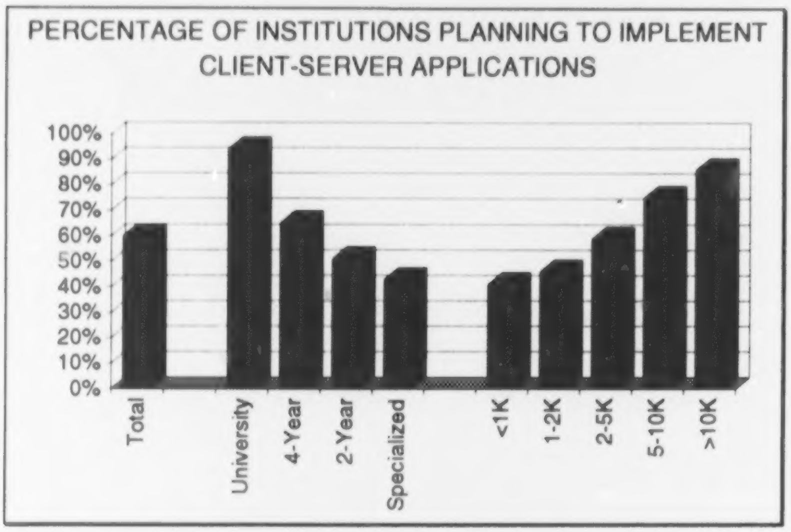
NO CONSENSUS ON CLIENT-SERVER

We asked: what does client-server mean to your institution?. Summarizing their answers, we see that a majority of respondents indicated that *client-server computing means that two systems cooperate -- in some manner -- to execute a task.* In keeping with the pattern of answers for "open" systems, we see that forty percent did not agree with any of the proposed models. Client-server definitions, like those for "open" systems, share a relatively low level of consensus. In reality, the only area of agreement is that neither application "downsizing" nor the networked terminal approach fulfills the definition of client-server computing. And, while there are many differing points of view with regard to "the" best approach to client-server computing, it still enjoys considerable popularity. *This emerging desktop-centric and network-connected computing model is much closer to the faculty work model than is a central computing operation, and it is being embraced with significant enthusiasm.*



WHO PLANS TO IMPLEMENT CLIENT-SERVER?

How many institutions are planning to implement client-server applications? MOST! Overall sixty percent said they were planning for the implementation of client-server applications. There are, however, significant differences across the total population. Ninety-six percent of the Universities; 65% of 4-Year; 51% of 2-Year and only 43% of Specialized institutions indicated plans for implementing client-server applications. The pattern by size of institution is just as strong: eighty-six percent of the largest schools have plans for client-server applications, in contrast to the smallest schools, where only 41% have similar plans.


PERCENTAGE OF INSTITUTIONS PLANNING TO IMPLEMENT CLIENT-SERVER APPLICATIONS

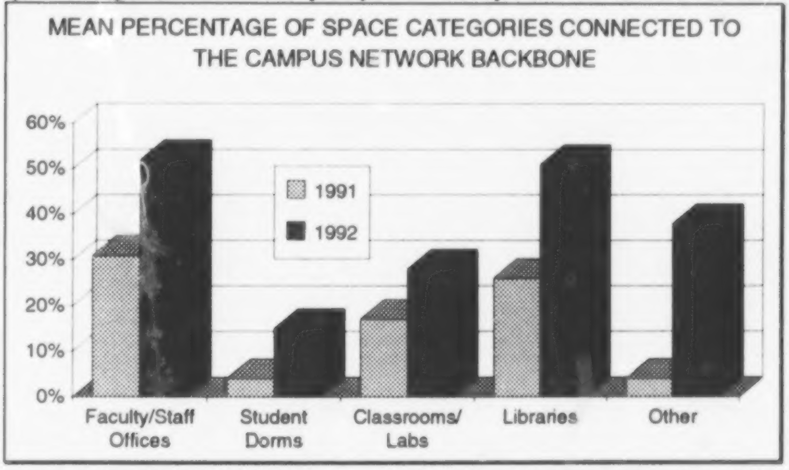
Clearly, most institutions are looking to move to client-server computing. The next question is why. We asked respondents to describe their primary motivation(s) for moving to client-server computing and what impediments might stand in their way. As to motivations, we found that "increased functionality" and "price/performance" were mentioned most frequently. In contrast, the list of the industry-wide factors such as "hardware scalability" and "industry trends," fell to the bottom of the ranking. The decision to move to client-server computing -- like that for UNIX -- is based on micro-level issues of need fulfillment and not on macro-level issues like molding the campus IT infrastructure to fit the changing computing paradigm.

Just as the motivations mentioned for moving to client-server mirror those for UNIX implementations, so do the impediments. "Money" and "staff/user skill sets" were mentioned by over three-quarters of the respondents. "Network infrastructure" issues were also mentioned as schools question whether their existing networks can support the increased network load brought on by client-server computing. Of note, however, is that none of the aforementioned issues is a specific indictment of client-server computing, but instead reflects the problem of moving a large existing base of hardware, software, and skill sets to a new and different paradigm.

No one expects the move to client-server computing to be without some level of pain, as most see the need for significant hardware realignment. Close to half of all schools said they expect the introduction of client-server computing to require both re-configuring existing equipment *and* retiring incompatible equipment.

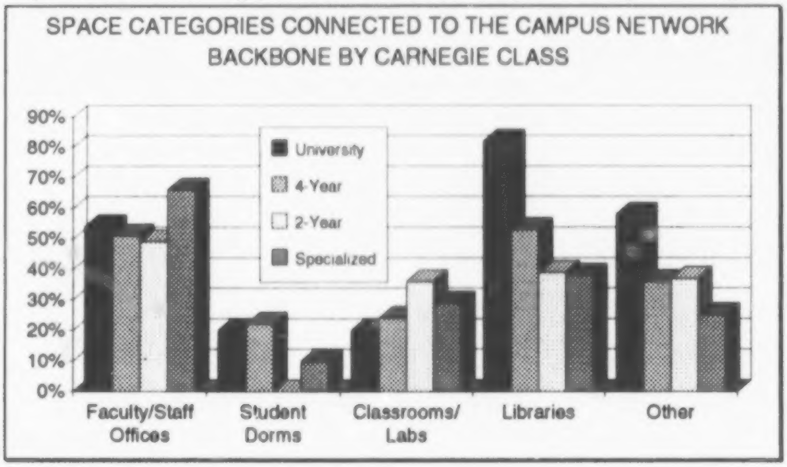
WHAT'S CONNECTED?

Has the anticipation of new computing models had an effect on overall campus connectivity? The answer appears to be yes. Starting at the top, there have been large increases in connectivity -- for all space categories -- over the past year. Faculty/Staff offices and Libraries enjoyed the highest rate of connection in 1991. These two areas maintain their top place in 1992, but with considerably more connections having been installed over the past year. Faculty/Staff offices have increased to 52% and Libraries to 51%... *And for the first time, we find some campus space categories with more connected to the network than not.* Of special note amongst this upbeat picture of network connectivity, is that of Student dorms. In spite of a large gain, they still trail all other types of space in access to the campus network, and this figure represents only those students living on campus. Missing entirely are the vast numbers who live off-campus. Indeed, many schools are trying to address this issue, but until everyone, including those students and faculty who live and work off-campus have equal access to the network, the dream of universal connectivity will remain unfulfilled!



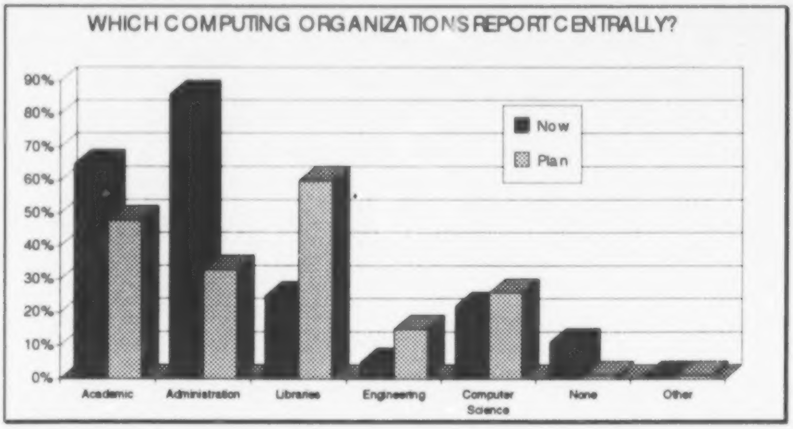
CONNECTIVITY BY CARNEGIE CLASS

Does connectivity vary by Carnegie class? Universities offer the widest array of network services. Do they also have the highest rates of connectivity for all space categories? The short answer is no. Universities do lead in network connections to Libraries and for "other" types of space, but fall behind in all other categories. The differences are not large, but they are only in second place for Student Dorms and Faculty/Staff offices. And are actually in last place in wiring Classrooms to the network backbone. In contrast, 2-Year schools lead all others in classroom connectivity.

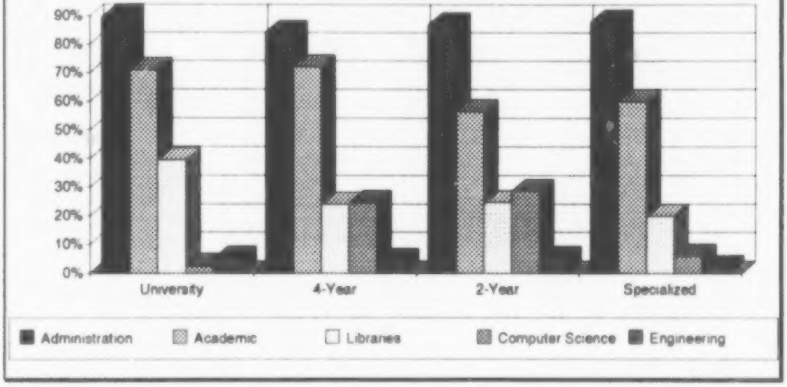


CENTRALIZATION... MORE OR LESS?

There is much discussion about distributing decision making in schools -- and with it -- the computing infrastructure to enable this change. As a result, one might expect to see a movement away from centralization of IT staff organizations toward a more decentralized model. We tested for the *current* and *planned* level of centralization. Respondents were given a choice of answering "now," "plan" or both. (Please note that a drop-off between "now" and "plan" *does not* imply declining centralization.) The results indicate that *schools are planning for more -- and not less -- centralization of computing operations.* Of the respondents who indicated that they were planning for *more* centralization, approximately fifty percent said they planned to include Academic computing and Libraries in their central organizations. Does this mean that increased decentralization of computing power will result in even more centralization of IT staffs as schools realize that they need central functions to ensure minimum standards for data security, network standards, data architectures, as well as their overall IT architectures?


WHICH COMPUTING ORGANIZATIONS REPORT CENTRALLY?

Switching now to a view which describes only the *current* level of centralization, we see that organizational reporting does vary by Carnegie class. And, some types of organizations vary more than others. Over eighty percent of *all* schools indicated that Administration reported centrally, and the differences vary only slightly by school type. Academic computing is the next most likely function to report to a central organization. Overall, sixty-five percent report centrally, but here we see variances across the Carnegie classes. Universities and 4-Year schools are above the mean response, and 2-Year and Specialized institutions are below it. It appears that one in four Libraries report centrally, but the range varies from a high of


CENTRAL REPORTING BY CARNEGIE CLASS

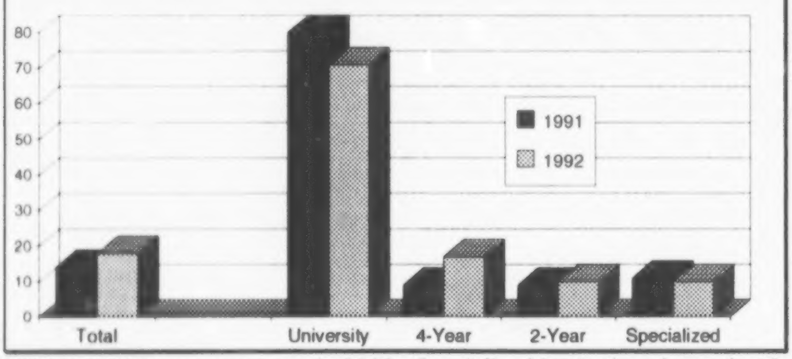
just under forty percent for Universities to a low of 20%, for Specialized institutions. Currently, about one in four Computer Science departments are likely to report centrally, and 2- and 4-Year schools lead the way, while Universities and Specialized schools anchor the low end of the curve. Finally, Engineering is the least likely -- for all Carnegie classes -- to report centrally.

... So why aren't more computing operations combined? *Politics!* In a related question, we asked respondents to define the major impediments to combining IT organizations. Money (or lack thereof) was mentioned most frequently, but when the responses for "institutions philosophy" and "culture" were combined, we discovered that over seventy percent of the respondents said the impediments to combining IT organizations were mired in organizational morass -- translate politics! Further, all types of schools mentioned the "political" issues. The span of responses ranges from a high of over 90% for Universities to a low of sixty percent for 2-Year schools. Personnel skill sets and all other impediments like data security, network infrastructure and remote campuses, etc. were mentioned by far fewer respondents. *The bottom line here is politics, the rest is commentary!*

STAFFING... UP, DOWN OR FLAT?

The general scenario at most schools calls for falling -- or at best -- flat budgets. What impact is this having on staffing for central IT organizations? *Our data suggests that overall staffing in both Administrative & Academic computing organizations is up slightly from 1991, but that there are wide variances by institution type and size.* Looking first at the overall picture of the mean number of full-time equivalents (FTE's) for all schools, we see that the 1992 figure is eighteen, an increase of four FTE's over the 1991 figure of fourteen. However, the increases are not spread evenly across all schools. Clearly, Universities have experienced the highest level of staffing cuts. Mean University staffing levels dropped from eighty FTE's in 1991 to seventy-one in 1992. Specialized institutions have also dropped slightly from eleven in 1991 to ten in 1992. Counterbalancing these cuts, however, are the increases for 2- and 4-Year schools. Four-Year schools almost doubled their mean FTE headcount as they moved from nine in 1991 to seventeen in 1992. The 2-Year schools also moved upward from nine to ten. Further, as we looked below this surface level and compared staffing changes by size of staff (as opposed to Carnegie class or institution size), we learned that *all* Carnegie classes -- with larger staffs -- experienced staffing decreases. Specifically, there were staff cuts for *all* schools with staffing ranges of fifty or more FTE's.

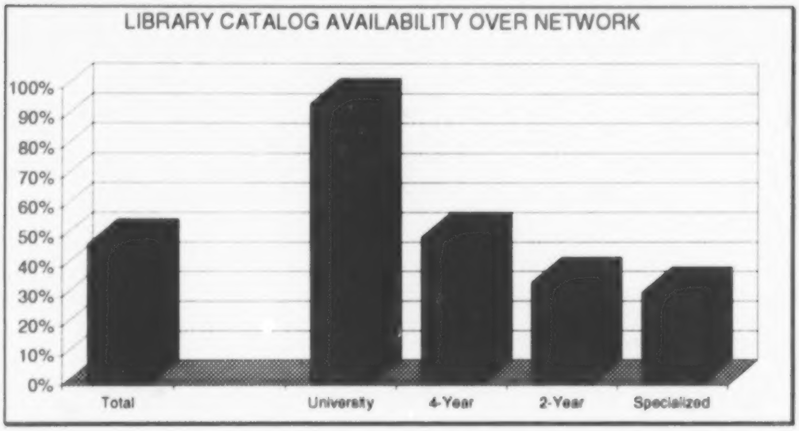
CHANGES IN THE MEAN NUMBER OF FTE'S EMPLOYED IN BOTH ADMINISTRATIVE AND ACADEMIC COMPUTING



IMPACT ON LIBRARIES

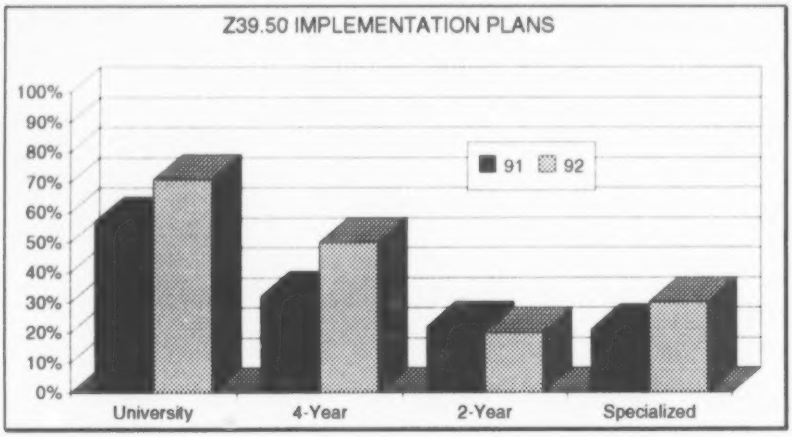
Is the library being affected by all these changes? The basic mission of the library is not changing, however user needs are changing and many of the strategies employed in its service delivery are being altered, some in a dramatic manner. More information is being stored and shared -- across the campus and around the world. Further, more people are accessing the same information... in different locations... at different times... and for different purposes. Since changes in strategy are usually accompanied by changes in structure, let's look at some of the most prominent structural changes.

With increased demands for on-line access to information, we would expect to see significant change in the level of library connectivity required to enable these changes... And we did. Currently, almost half of all schools provide network access to the library catalog, and this is almost twice the rate we saw in our 1991 Study. However, the picture varies considerably by Carnegie class. Universities lead the way, with ninety-five percent offering library services to their network users. The 4-Year schools reflect the industry average, and about one half of them offer this service. In contrast, the 2-Year and Specialized institutions are well below the industry average, with only one-third reporting network access to the Library catalog.



CONNECTING LIBRARIES TO EACH OTHER

With half of all schools offering network access to their own library materials, the next likely step is resource sharing with other institutions. There is trend toward formal cooperation among libraries in order to provide better access to scholarly materials, and in some cases, to enable individual institutions to restrict the breadth of their own collections. One test for growth in this resource sharing thesis would be to find a significant increase, over the last year, in the



number of institutions implementing the Z39.50 NISO standard. It provides for transparent exchange of data between systems that use different hardware, applications software and operating systems. And we did find marked increases across all Carnegie classes except for 2-Year schools.

SUMMARY

The general consensus is that the entire realm of information management is changing -- and at a very rapid rate. We see a coincidence of new management and new computing models, with information now being viewed as a prime enabler in meeting institutional goals. Further technology needs are becoming more complex as more users -- in more disciplines -- use new forms of data like voice, text and images... And the rate of technological change continues its onward march. Yesterday's solutions -- or even today's -- will not meet tomorrow's needs... *In this environment, the institutions that will benefit most from IT are those who are not just embracing change but, instead, are actively planning for it and driving it.*

Bucking the Trend: Developing a Centralized, on-line Student Information System in a Heterogeneous Multi-Campus Environment

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The University of Pittsburgh has developed and implemented a comprehensive, centralized, on-line student information system. The system replaces formerly autonomous systems at the University's five campuses and nineteen schools, and interfaces with local systems designed to meet unique user needs. This paper reviews the development and implementation of the system, with particular emphasis on the special circumstances faced in delivering centralized administrative services at the University's regional campuses. It focuses on the ingredients contributing to the success of the system, including attaining senior management support, involving users, reviewing and revising policies and procedures, establishing an applications development model, setting development priorities, establishing human and data communications networks, creating software training and testing environments, and delivering production services.

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Background

The University of Pittsburgh is an independent, nonsectarian, coeducational, public research university. It is a state-related member of the Commonwealth of Pennsylvania System of Higher Education. Located in Oakland, Pittsburgh's cultural and medical center, the main campus is within an hour's commute for 2.3 million people in the metropolitan Pittsburgh area. Its 132 acres include more than 90 academic, research, supportive, and dormitory buildings. One of these, the 42-story Cathedral of Learning, is among the tallest academic buildings in the world.

The University of Pittsburgh, founded in 1787, has grown to become the comprehensive educational complex in the tri-state area bordering Western Pennsylvania. It attracts national and international programs and students. In addition to the main campus in Pittsburgh, the University operates four regional campuses. The Johnstown, Greensburg, and Bradford campuses offer four-year baccalaureate programs, and the Titusville campus offers lower-division programs and two-year degrees. Among its five campuses, the University offers over 390 degree programs, and for fiscal year 1992, conferred 6,728 undergraduate, graduate, and professional degrees. The following table shows enrollment for Fall Term, 1991, at each of the campuses.

Campus	Distance (from Pittsburgh)	Faculty/Staff (full- and part- time)	Enrollment (headcount)	Percentage (of headcount)
Bradford	170 miles	173	1,241	4%
Greensburg	35 miles	150	1,454	4%
Johnstown	80 miles	377	3,243	9%
Pittsburgh		10,228	27,973	82%
Titusville	125 miles	75	425	1%
Total		11,003	34,336	

Statistics are based on the 1992 University Fact Book

Student Systems before the Project

The University has recently completed a project to centralize formerly autonomous student information systems at all five campuses. The project began in earnest in 1986, with phased implementation occurring from 1989 through 1991. The development process required close cooperation and coordination among senior administration, mid-level management, faculty and staff, and a significant commitment of time and financial resources. The project had a far reaching impact on the formation of policies and procedures throughout the University and dramatically improved the quality of student services.

Because different local student information systems had evolved at each of the University's five campuses, coordination between these systems was extremely difficult and very limited.

BEST COPY AVAILABLE

Administrators who needed to analyze information across the entire University were forced to rely on printed summary reports generated from these local systems, which often did not contain comparable data elements. It was impossible to reconcile the summary information with the detailed source data.

The five campuses operated their own student systems at varying levels of automation and sophistication. The Pittsburgh Campus system was the most complex, serving professional, graduate and undergraduate programs offered by 15 schools. This system was implemented on different platforms at centralized, school, and departmental levels. The centralized component, supported by Computing and Information Services (CIS), had been implemented on two antiquated platforms, a DEC-10 and IBM OS/MFT system. These batch systems provided centralized student billing for the entire Pittsburgh campus, but some academic units had their own local recruitment, admissions, registration, and transcript systems.

At the Regional Campuses, administrative computing systems were supported by local, autonomous computer centers. Their systems ranged from home-grown microcomputer-based programs through sophisticated, integrated systems. The Bradford campus had implemented a comprehensive, integrated, on-line system on a local VAX 8350 using Series Z software from Information Associates. The Greensburg campus used a combination of manual systems and software developed using the 1022 data management system on the University's administrative DEC-10. They also used components of CMDS's TEAMS on-line student information system on a local IBM System/34 that they inherited from the Bradford Campus. The Johnstown campus developed a student information system to run on their local Novell network using DataFlex. This system was supplemented by software developed on the DEC-10, and by recruitment and admissions software on a local Macintosh-based network. The Johnstown campus also utilized the state's PHEAA system for packaging and managing financial aid. The Titusville campus relied mostly on a microcomputer-based system developed locally using FoxPro.

Development and Implementation

Detailed planning for the proposed on-line student information system began with the establishment of a planning team charged with recommending a solution to replace the batch systems at the Pittsburgh campus. The planning team was headed by the Vice Chancellor for Planning and Budget, and included administrators from various operating offices at the Pittsburgh and Regional Campuses, as well as Computing and Information Services. The team defined the required functional capabilities of the systems and the general requirements for system reliability, hardware, software, and telecommunications. These requirements were reviewed and approved by staff with operational responsibilities, and were included in a Request for Quotation.

After analyzing the costs of developing a student system in-house, and reviewing responses to the RFQ, the University decided to purchase an integrated system and modify it to address the specific needs articulated by the University community. The Integrated Student Information System (ISIS) system was purchased from SCT Corporation, because its basic architecture and breadth of applications most closely approximated the general needs that had been outlined. With the acquisition of ISIS, it was also necessary to acquire new hardware (an

IBM plug-compatible mainframe), an operating system (MVS), telecommunications monitor (CICS), database management system (Cincom's SUPRA), and other software to support a production processing environment. These changes also required an extensive recruitment and training effort for both development and user personnel.

Because operational processes were quite different at the various campuses and academic units, a project development team, consisting of staff from CIS and users from major administrative areas, was given on-line access to the baseline software and directed to determine what specific changes needed to be made. To ensure that scarce development resources would be used effectively, this activity was deliberate and time consuming. However, because of the tight development schedule and poor condition of existing systems, it had to be completed expeditiously in order for the project to be fully implemented as quickly as possible.

While analyzing baseline ISIS functionality, the development team realized that there were few written University-wide policies to guide their operational design decisions. Therefore, a University-wide committee was established, under the direction of the Provost, to address student and course-related policy issues and to specify relevant data definitions. Among the 47 policy issues addressed were policies defining the repeating of courses, standard course meeting times, tuition assessment, grading, and transcript format. An example of the committee's deliberations was the issue of establishing one versus multiple course inventories. Before the ISIS project, Mathematics 101 may have been defined differently by as many as six academic units, creating many serious problems, including the evaluation of transcripts for internal transfers. The ISIS project provided the opportunity to define a new policy creating a single course inventory across the University. Simultaneously, a Data Element Dictionary was developed for all administrative systems at the University. This dictionary housed all data element definitions contained in administrative applications as well as their format, values, and relationships. This activity was a critical prerequisite to the task of building system tables for the application software.

After completing estimates of the effort required to program the planned modifications, a development and implementation schedule was detailed and presented to users and the senior administration for final approval. The major modules of the overall system were carefully analyzed and a final phased implementation schedule for all campuses was prepared. There were over 3,000 tasks on the final implementation schedule. In order to manage the development and implementation of these proposed modifications, the Executive Vice Chancellor for Administration appointed a Project Coordinators Group. The group was chaired by the Director of Administrative Information Systems, who was also the overall project director, and included directors of major administrative areas. The group set priorities, evaluated development costs, and recommended alternatives to the Executive Vice Chancellor for Administration. All non-essential changes were identified for post-implementation review.

Because of the excessive number of modifications necessary to develop the financial aid component to meet University specifications, the Project Coordinators investigated the possibility of interfacing existing third-party software. After considerable analysis, the coordinators selected the Student Aid Management System (SAMS), from Sigma Systems, Inc., and proceeded with plans to interface and integrate it with ISIS. Other systems that needed to be interfaced with ISIS included the Financial, ID Card, Library Automation, Data Element Dictionary, Alumni Development, and Human Resource Systems.

A significant development activity involved the conversion of ISIS and SAMS to the SUPRA database management system, optimizing their performance, and developing dynamic system interfaces between the two. Additional development work was also necessary to convert data from the then-current student systems into ISIS and SAMS. The Project Coordinators planned and closely monitored the conversion and verification of student demographic information, academic transcripts, course information, accounts receivable balances, and student aid history. The conversion of transcript data made it possible to generate a complete transcript on-line for any student actively enrolled at the University.

Modules were phased into production beginning with the course inventory module in 1989, and ending with the graduation component of the academic history module in the spring of 1991. In all, 64 new screens were developed in addition to the 105 that were either adopted or adapted from the baseline systems. Each of these screens represents several programs for add, change, delete, and query transactions.

Application	Vendor	Baseline Screens	Additional Screens
Integrated Student Information System (ISIS)			
General Utilities	SCT Corporation	8	4
Recruitment	SCT Corporation	N/A	3
Admissions	SCT Corporation	7	6
Course Inventory	SCT Corporation	3	1
Course Schedule	SCT Corporation	5	5
Registration	SCT Corporation	7	3
Housing	SCT Corporation	1	2
Accounts Receivable	SCT Corporation	14	8
Academic History	SCT Corporation	13	6
Academic History Conversion	Internally Developed	N/A	6
Special Applications	Internally Developed	N/A	7
Student Aid Management System (SAMS)	Sigma Systems, Inc.	47	N/A
Automated Loan Processing System (ALPS)	Internally Developed	N/A	6
Degree Audit System (DAS)	Internally Developed	N/A	7

Keys to Successful Project Implementation

The successful development and implementation of an on-line student information system in the University's heterogeneous multi-campus environment was a major accomplishment. The key ingredients in achieving this success included the retention of active senior administrative support, the management and control of the development process, the close involvement of users, the efforts at communicating and coordinating project activities, and the expansion of centralized computing services.

Attain Support of Senior Administration

A critical factor in the success of the project was the continued active involvement by the senior administration. There would inevitably be times when it would be necessary to break a

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dead lock regarding policy issues, when unanticipated additional funding would be necessary, and when schedule slippage would occur. Decisions regarding such issues would have to come from the senior administration. The Executive Vice Chancellor for Administration met with the Project Coordinators on a biweekly basis to review the status of the project and make timely decisions on all important issues.

A second area of administrative support involved the identification and resolution of policy issues that needed to be addressed in order to implement the software. Because student systems at each campus and some academic units operated autonomously, varied policies and practices had evolved before ISIS. In order to control the costs associated with modifying the software to accommodate these diverse policies, as well as to establish consistent services across the University, the Provost appointed an Academic Policy Committee composed of deans and administrators. This committee identified and resolved policy issues that laid the groundwork for the successful implementation of ISIS.

The third area of administrative support focused on the one-time costs incurred in developing and implementing the project. This support encompassed all components of project implementation, including the extension of the University network to administrative offices, the purchase and support of terminals and local printers, funding to develop training materials and conduct training sessions, and funding to hire temporary staff for data conversion activities. In addition to providing the needed resources, this centralized support clearly demonstrated to the institution that the senior administration was committed to the successful implementation of the project.

Manage and Control the Development Process

An important factor in the management of the project was the creation of the Project Coordinator group. Chaired by the Director of Administrative Information Systems, the group consisted of directors of major administrative areas who met on a weekly basis to resolve functional, technical, and political issues. They closely monitored development progress, analyzed and adjusted development plans and resources, approved functional specifications, and approved new and revised forms and procedures.

A second factor in the successful management of the project was the set of procedures put into place to control the development and implementation process. Standards had to be developed and followed in order to ensure that the project deliverables were properly prepared and could be maintained and supported after cutover. These included standards for programming and JCL, user-approved documentation, a methodology for maintaining current documentation, and standards for estimating software changes and monitoring those estimates.

As the first major project of its kind at the University, a systems development methodology was created to meet the needs of both CIS and the users. This methodology, outlined below, was subsequently adopted as the standard for CIS.

- Information Flow Diagrams: Similar to work flow diagrams, these diagrams depict how the system should work operationally. Once approved by the Project Coordinator group, they serve as a "road map" for the development of functional specifications.

- Functional Specifications: Developed by module, (i.e., recruitment and admissions, registration, etc.) these specifications include screen layouts, descriptions of screen processing and functionality, report layouts, error message checking, data element definitions, and general assumptions relative to module functionality. Each specification serves as a basis of understanding between the users and CIS, and is reviewed by users and formally approved by the Project Coordinators.
- Program Specifications: Based upon approved functional specifications, program specifications includes all items necessary to fully describe the program requirements. These specifications normally are reviewed with the user, via a program "walk-through," before proceeding with coding.
- Unit and Module Testing: After coding is completed, new software is installed in a special environment dedicated exclusively to acceptance testing. Users then test each set of software, focusing on test case performance, module test performance, error message logic, and stress and destructive testing. The intent is to minimize production surprises, and to measure coding against pre-defined functional specifications.
- Formal Approval: The final step in the systems development methodology involves obtaining formal user approval of the software as a prerequisite to implementation.

In support of this methodology, it was critical that separate application environments be maintained for separate functions. These were implemented on the mainframe in separate CICS regions, each containing a separate database and different versions of the software. In the initial months of the project, an environment containing the baseline (non-modified) version of the software enabled users to familiarize themselves with the basic functionality of the system. A separate development environment was created to allow CIS to code and unit test new and revised software. An acceptance testing environment was created where users could experiment with newly created software and closely monitor its performance and accuracy before it was implemented. A training environment was created to enable CIS to train and prepare the University community for initial implementation. Finally, the production environment contained fully tested software and real data.

A final factor in controlling the development process was the concept of "change control." The change control process was a procedure initiated to address suggested changes to the functionality of the software after the functional specification had been approved and programming had begun. The Project Coordinators reviewed all change control documents and approved them only after fully evaluating their impact on the project budget and schedule. This process was critical in a situation where resources were limited and there was no room for slippage in a tight development schedule.

Involve Users

One of the primary underlying philosophies of the project implementation effort was to ensure that users be involved from the very beginning of the project through implementation. In addition to functional knowledge, users within the University community possessed a wide range of technical talent. This project capitalized on this situation by assigning technically oriented users to the development team. Such involvement captured the users' operational expertise and understanding of system requirements, thereby dramatically increasing the probability of success. This philosophy became the cornerstone for a team approach to project development, entailing direct user involvement and final responsibility for overall review and approvals.

Users were significantly involved with Computing and Information Services in all aspects of project management. They helped to evaluate and select software, to analyze and recommend policy revisions, and to recommend implementation schedules and priorities. Most importantly, they co-authored the functional specifications that defined what the system would do. Another significant area of user involvement was in the design, development, and execution of software testing plans. After CIS developed program specifications, users participated in walk-throughs to ensure that the system would be developed as intended. Users also tested, evaluated and approved all new and revised software, before it migrated into the production environment. Of particular importance was the use of "destructive testing" strategies, whereby the users intentionally tried to crash the software and corrupt the database.

User involvement played a critical part in the success of the project. It built a sense of ownership among users, fostered an overall positive team attitude, developed mutual trust and confidence, and encouraged a high level of commitment. The development methodology required significant user involvement and was highly instrumental in helping to strengthen these intangibles.

Communicate and Coordinate

Two important keys to the successful implementation of ISIS were the efforts at project coordination and the establishment of an open, varied, and effective system of communication. To help coordinate project activities between the Project Coordinators and the users, the role of Master User was defined. The Master User served as liaison between a specific area of responsibility and the ISIS project management. The Master Users were selected from user offices and charged with the responsibility to disseminate information to users in their areas, to coordinate requests for user access to the production system, to administer screen access (transaction security) within their functional areas, and to request system table updates.

At the Regional Campuses, the role of Master User took on even greater importance. At each campus, this role was assigned to the person who was responsible for local administrative computing, typically the local computer center director. These Regional Campus Master Users were charged with implementing all components of ISIS at their individual campuses. In addition to the standard duties of Master User, they coordinated equipment installation, set up training sessions, managed printers and printer queues for their campus, and fielded local production problem calls, interfacing with CIS regarding their solution. One of their most important responsibilities was to review functional specifications with users on their campuses, to suggest modifications and to approve the specifications. These activities were supported by a newly created position within CIS that was dedicated to coordinating all Regional Campus activities.

As the project progressed, communication and coordination between the campuses became more and more important. The Regional Campus Master Users held regular face-to-face meetings at the Pittsburgh campus, and were often represented at the weekly project coordination meetings. To facilitate communication between the campuses, the Associate Provost hosted several meetings dealing with policy and priority issues. Also, comparable functional units (such as all Registrars) from each campus met several times annually at one of the campuses to discuss procedural issues and upcoming software modifications.

Wherever possible, technology was used to facilitate communication. For example, the Regional Campus Master Users held weekly telephone or video conference calls to participate in planning and problem solving activities with CIS managers and analysts. All members of the project team used electronic and voice mail on a regular basis to facilitate communication. Electronic mail was also used to announce software changes and to gather appropriate approvals for moving changes into the production environment. The Regional Campus Master Users also shared information and programs of mutual interest in commonly accessible disk space on the mainframe processors. This space was used to store parameter card documentation, meeting agendas and minutes, problem reports, shared examples of JCL and report writer coding.

A final critical aspect of communication was the effort to educate the University community regarding the project. To prepare for implementation, the Project Coordinators conducted orientation sessions and open forums for the general University community. These sessions were aimed at familiarizing faculty and staff with the operational implications of the policy and procedural changes associated with project implementation. Training activities throughout the University were coordinated by a newly created position within CIS. In conjunction with the development team, this trainer developed user documentation and training materials for the on-line screens and batch reports, set up training data in a dedicated training environment, and conducted group training sessions. Users also participated directly by developing quick reference guides to on-line screens.

Expand Centralized Computing Services

Special efforts were required to create and support an effective computing environment that would facilitate the success of the project. A critical prerequisite for the centralized system was the creation of a University-wide data communications network. The network infrastructure was created as part of the Campus of the Future Project, a joint venture between the University and several major corporations that addressed the academic, administrative, library automation, video, and telecommunications goals of the campus. Among other things, this project resulted in the cabling of all five campuses with a fiber-optic backbone, along with thinwire and twisted pair station wiring. The Regional Campuses were connected to the network via T1 communications lines. This University-wide network, called PittNet, provided the ability to connect all computing devices, including mainframes, minicomputers, microcomputers, and terminals, at all campuses. As part of the ISIS project, CIS provided a low-cost color microcomputer, terminal emulation software, and a network communication port to each user who required access to the student system.

Historically, CIS had not been charged with providing administrative computing services to the Regional Campuses. The development of this centralized student system required CIS to make several significant changes to its internal operating policies and procedures in order to successfully extend its services to remote users. For example, at the Pittsburgh campus, procedures required the submission of a multi-part paper form, along with a parameter card form, to request a batch update or report job. To address the problems inherent with implementing such procedures via the U. S. Mail system, an alternative system was developed for the Regional Campuses. The Regional Campus Master Users submitted e-mail requests to run jobs, updated the batch parameter cards on-line, and could print the job output at their campus the next morning. They also used e-mail to request system table updates, modify batch schedules, set up weekly production runs, request transaction security access, and request ad hoc mailing label jobs.

Printing on-site at the regional campuses proved to be one of the most difficult tasks associated with the project. Most ISIS reports were modified to be printed on laser printers using a technique of overlaying an electronic form with data. This provided flexibility in that output could be printed on plain paper, obviating the need to stock expensive forms. Laser forms also allowed for the ability to change form layouts on shorter notice and at substantial cost savings. Forms design software allowed for the generation of forms for both the central high-speed Xerox laser printers that serve the Pittsburgh campus, and for tabletop laser printers located in user offices at all campuses.

Although the multi-campus student information system was the first major on-line transaction oriented system installed at the University, the Project Coordinators knew from the beginning that this system would require special planning for support after initial implementation. With over 1,000 users, it would be necessary to have a structured support system in place to respond to trouble calls quickly and to answer all questions regarding proper operation of the system in a professional manner. The project plan included tasks for defining such a support environment, including automated support systems for monitoring problem calls.

A trouble line was implemented and staffed by individuals dedicated to taking all initial telephone calls and recording the problem into an automated system. The system then reported all pertinent information to the individual having support responsibility for the problem. That individual then typically called the user office reporting the problem within ten minutes after receipt of the problem, and advised as to a likely time for resolution. Management reports were produced daily to monitor all problems, identifying any continuous problem areas that may need a more in-depth analysis. This problem reporting and monitoring system, although rather simple in structure, was an essential component of a central on-line system.

Retrospective and Vision for the Future

The development and implementation of this comprehensive multi-campus system was a major success. The project involved a complete transition of technology, an infusion of new technical employees, and a very stringent implementation plan. These factors, combined with the uncertainties of a first-of-its-kind development effort at the University, suggested that major difficulties would be inevitable. As these difficulties were encountered, the project received the necessary senior level support and user commitment to resolve them in a timely fashion. In addition, CIS development personnel played a very important role in ensuring system reliability, performance, and integration. In the final analysis, it became evident that the human aspects of a project of this magnitude are equally or more important than the technical aspects.

The success of the project can be attributed to several key factors. The senior administration provided on-going financial and political support, and active project oversight. The Project Coordinator group played a leading role in the successful development and implementation of the project by keeping activities focused and adjusting to events in a timely fashion. This role continues, in the post-implementation environment, with the oversight of on-going support services and the evaluation of proposed enhancements and modifications.

The approach to project development placed a good deal of emphasis on the team concept with full participation and responsibilities from user offices. This involvement built a sense of ownership among users, and fostered an overall positive team attitude, developed mutual trust and confidence, and encouraged a high level of commitment. A varied and effective communication system kept users current with development activities, and kept CIS responsive to user needs. The establishment of strong project coordination for the Regional Campuses (a mid project change) also turned out to be an extremely important and accurate decision in efforts to implement the system at all campuses at the same time.

The project development methodology required significant user involvement and was highly instrumental in ensuring the quality of the software and its responsiveness to user needs. The strategy of selective phased implementation was also important because it provided for demonstrated success and the opportunity to learn as the development team proceeded toward the implementation of critical and high visibility modules such as student aid, student receivables and the dynamic integration of these two modules. Also, the expansion of centralized support services provided assurance that the system would be appropriately supported. A trouble line and method of responding to system operational issues was extremely helpful, as was the decision to dedicate personnel to the on-going support of the system in both CIS and the user offices.

Where Do We Go From Here?

One important capability that has not yet been implemented is the establishment of an effective ad hoc management reporting environment. Many of these needs are currently satisfied through downloading data to local computing environments and can be satisfied more efficiently through a more powerful information reporting tool with a more sophisticated data base environment.

One of the "down-sides" of this major project effort was the inability to simultaneously address similar needs in other administrative areas, particularly Financial and Human Resources systems. However, the lessons learned, and the successes of this project have significantly strengthened confidence in centralized systems and the ability to deal with a number of major projects that are perched on the horizon.

While we have begun to develop a strategy addressing client/server applications for ad hoc query and reporting support, we are convinced that the centralized transaction processing model, coupled with a system of distributed support services, is most efficient for high volume transaction systems.

CORPORATE PARTICIPATION

Coordinator: Margaret DuFala

Participating in CAUSE92 were 59 corporations that offer solutions to higher education information technology needs. A list of these corporations appears on the next page, followed by descriptions of some of the products and services they offer, and their participation in this conference. Their offerings at CAUSE92 ranged from corporate presentations, workshops, and exhibits, to sponsorship of special conference activities and suite hospitality. A number of them also gave presentations at the first-ever post conference sessions, held at INFOMART, a unique showplace for high technology.

PARTICIPATING CORPORATIONS

CAUSE appreciates the participation of the following corporations in CAUSE92:

American College Testing
American Management Systems
Andersen Consulting
Apple Computer, Inc.
Applied Business Technologies, Inc.
Applied Collegiate Systems
Ascot Technologies, Inc.
Boling, Orahood & Associates
Campus America, Inc.
CARS Information Systems Corporation
Data Flow Systems, Inc.
Data Research Associates, Inc.
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Information Builders, Inc.
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Pinnacle Software Corporation
Quodata
Recorded Resources Corporation
Sequent Computer Systems
Sigma Systems, Inc.
Software AG
Southwestern Bell
Spalding Corporation
Sterling Software, Dylakor Division
Syntellect
Systems & Computer Technology
Telco Research Corporation
Texas Instruments
The College Board (CSS Software Services)
The Robinson Group
The Ultimate Corporation
VTLS Inc.
WolffPack, Inc.
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ACT Demonstrates SAFE®

at CAUSE92

American College Testing, (ACT), is a premier provider of financial aid services to higher education. The country's largest processor financial aid applications, ACT offers a variety of software products to assist institutions in the delivery of financial aid to students. During CAUSE92, ACT's booth was dedicated to its IBM mainframe financial aid system, SAFE® .

The SAFE® System, which made its debut over 20 years ago, is a state-of-the-art system. Included in its many unique features are its single database design and its multi-level, multi-term processing mode which provides a great advantage to institutions which enroll students who change enrollment status each term. Another unique characteristic is the importance user institutions play in refinement of the product.

The SAFE Family consists of colleges, universities and state agencies using the SAFE® System. Interaction and exchange of information takes place often and provides beneficial results for the entire SAFE Family. The SAFE Family gathers each March in La Jolla to receive updated information about the system. This "mandatory" workshop lasts three to four days. Emphasis is on new feature, benefits, and regulatory changes; additional time is allocated for an open forum.

The SAFE National Advisory Committee was formed in 1988 to ensure the system remains responsive to the needs of the SAFE Family members. The Committee meets twice a year and assigns priority to requests for enhancements which are submitted by SAFE Family members. These prioritized enhancements are then analyzed for implementation into the SAFE® System.

Online communications among SAFE Family members and ACT staff are maintained through two Bitnet LISTSERVs.

ams® American Management Systems

"TOMORROW'S SOLUTIONS TODAY"

AMS would like to extend our appreciation to CAUSE92 participants for your continued interest in our products and technologies. AMS was pleased to once again take the opportunity to demonstrate our products, introduce new business partnerships, and discuss the technology which has made AMS the industry leader in Higher Education Administrative Software.

Description of Exhibition

Featured this year were the *LEGEND* Series of administrative software products for higher education. These include the College and University Financial System (CUFS), the Student Information System (SIS) and the Human Resource System (HRS). AMS is also proud to introduce several new additions to our *LEGEND* products line including the Facilities Management System (FMS), the Research System (full cycle grant and contract management), and several new Document Imaging products.

The AMS *LEGEND* Family of Software Products

- ☐ **SIS/*LEGEND***— the AMS Student Information System, includes four comprehensive systems to support Admissions, Financial Aid, Student Records, and Student Accounts, as well as optional subsystems for Housing, Degree Audit, and touch-tone registration. These subsystems operate in a modern technical environment with advanced features such as dynamic menu generation, rules definition, and user-defined screen sequences.
- ☐ **CUFS/*LEGEND*** — the AMS College and University Financial System, provides on-line support for all aspects of financial management, including fund accounting and encumbrance control, budgeting, general ledger, accounts payable, accounts receivable, cash management, and automated cash disbursement. A wide range of optional, fully integrated subsystems are available including advanced purchasing, grants management, inventory control, job cost accounting, fixed asset management, cost allocation and endowment management.

Introducing Three New Additions to Our *LEGEND* Family

- ☐ **FMS/*LEGEND***— the AMS Facilities Management System, provides comprehensive facilities management services in the *LEGEND* tradition. FMS capabilities include space and equipment configuration, fleet options and maintenance, violations tracking and security, materials and hazardous materials management, and long-range planning and budgeting. FMS provides seamless integration across client server mainframe, graphical user interface, and integration with other university administrative systems.
- ☐ **Research System/*LEGEND*** — the newest addition to the *LEGEND* family, the Research System provides a full suite of grant and contract management services. Specifically addressing the complexities of grant and contract management within a large institution, the Research System provides capabilities including funding opportunity identification, proposal development management, award administration, award set-up and notification, and integrated decision support.
- ☐ **AMS Document Imaging System** — is available in conjunction with several *LEGEND* products. Document Imaging provides high quality electronic storage and retrieval of paper documents, fully integrated with other information. The AMS Document Imaging solution improves record access and client service, allows simultaneous document access, and can be implemented as a stand alone LAN or with a mainframe. This system is particularly useful in a financial aid environment where records are typically a combination of electronic and paper documents.

AMS Professional Services

AMS has become a trusted business partner for our college and university clients. Our project team has extensive experience in providing full cycle solutions of complex information management problems within the higher education community. As one of the nation's largest systems integrator, AMS has leveraged company wide technology into our *LEGEND* products which provide the most advanced capabilities available in the market today.

Feature Presentation

Topic:

Reengineering Business Processes Through the Application of Advanced Technologies

Presenters:

Dr. Fred Forman, Executive Vice President, AMS

Mr. Mark Olson, Deputy Vice President
Student Financial and Information Services, Columbia University

Abstract:

Columbia University and AMS have been two years into a partnership to apply advanced technologies to improve student services, expand information accessibility, and increase management effectiveness and control. Success has been achieved in several dimensions: revamping business processes, implementing new information technologies to solve business problems, and sharing the participation and rewards via an effective partnership. A partnership model for pioneering new information technology and business practices was described and discussed with the participation of the audience.

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Cris Meyers
Marketing Communications Manager
American Management Systems
1777 North Kent Street
Arlington, VA 22209
(703) 841-2100

Applied Business Technologies, Inc.

ABT had the distinct privilege of participating in a CAUSE conference for the first time at CAUSE92. The experience was both rewarding and fulfilling.

Although ABT is a small company, we have seventeen years experience in serving the smaller college market. We are a company that is a leader in applying newly established technologies to the problems posed by collegiate administration. As such we were pleased to see the emphasis that CAUSE and its member organizations are placing on such topics as networks, client / server computing, and SQL database managers.

At CAUSE92, ABT exhibited ABT CAMPUS version 4.4, the newest edition of our product that is due for full release in April, 1993. ABT CAMPUS version 4.4 takes advantage of the technologies mentioned above to provide a fully integrated and robust environment for college-wide administrative information management.

While we enjoyed speaking to all of the CAUSE92 attendees who stopped by our booth (including those who stopped by just to have a chance at winning our briefcase full of money), we were extremely gratified to hear the positive comments about the direction that our software has taken, the flexibility that it provides, and its ability to provide users of ABT CAMPUS with a single integrated workstation on their desktops.

The ABT CAMPUS system, and the people behind it, are dedicated to continue taking advantage of the technological advances that occur at an ever increasing rate. This is accomplished through an open design philosophy that gives our clients an open-ended method to keep their administrative systems vibrant over the life of their investment.

The technical nature of CAUSE users allowed ABT to display the fine points of our products, services and functionality to a knowledgeable and influential group of administrators.

For further information about ABT or ABT CAMPUS please call Stuart J. Maleeff, Sales Manager at 800 / 220-2281. Or write us at:

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SYSTEMS
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Coral Springs, FL 33071
Tel: (305) 345-8555 Fax (305) 345-8554

CAUSE92 INTRODUCES A NEW CORPORATE MEMBER

ATI Systems appreciated the chance to exhibit our business application solutions at CAUSE92 in Dallas. This was our first presentation to CAUSE as a new corporate member, and we are pleased with the enthusiastic response to our authorization control system, **ID/admin™**.

Our demonstrations of this cost-effective front-end application solution, featuring **on-line signature capture and retrieval, integrated document imaging, and automated paper and work flow control**, produced 50 universities who are moving in this direction in 1993. Many of these institutions are actively discussing the technology with ATI and its integration into their campus-wide administrative networks.

Demonstrations increased significantly during the last few hours of the exhibition, as word spread of our real-time approach in controlling data and system security, authorizations, paper flow, approvals, and auditability, for requisitions, purchase orders, payroll time sheets, student record management, and fleet management within the administrative operations of the university.

ATI Systems has targeted higher education as its primary marketplace. The technical resources of the company are directed toward cost-effective business application solutions which serve the administrative functions within the university system. Rapidly changing technology has opened new vistas to educational systems in the downsizing of hardware and the operating systems that drive them. ATI prides itself in its ability to provide this cutting-edge computer environment with the right-sized business application solutions needed to carry automation in university administration systems into the 90's and beyond.

ATI works closely with the international Big-6 consulting firm of Coopers & Lybrand (C&L) in the incorporation of accepted audit, security, and control procedures within **ID/admin**. C&L, among the largest firms of professional consultants and accountants in the world, acts in a quality assurance role in ATI's **ID/admin** implementations, and is involved in enhancements to the product.

Features and benefits of **ID/admin** include improved staff productivity and work control, and high level security and audit trail capabilities. ATI's methodology in the level by level implementation of **ID/admin** can lead to the paperless environment we all seek in day-to-day operations, without the pain and high cost usually associated with the "brute force" approach being touted by equipment vendors.

If you did not attend CAUSE92 or were unable to stop by our booth, call (305) 345-8555, or fax your information request to ATI Systems at (305) 345-8554.

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CAUSE 1992 NATIONAL CONFERENCE

DALLAS, TEXAS

BOA

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FULL SERVICE CONSULTING FIRM FOR HIGHER EDUCATION

Boling, Orahood & Associates, Inc. (BOA) is a full service consulting firm concentrating on higher education and post secondary education. BOA provides services in planning, procurement, project management, telecommunications, administrative software, hardware, downsizing and re-engineering.

Through a coast to coast network, BOA professional consultants work to optimize an institution's technological investments. BOA brings to clients **"THE POWER OF EXPERIENCE"** through its cadre of practitioners who have spent many years in all facets of higher education.

"CICS on UNIX"

DOWNSIZING ALLIANCE WITH VISYSTEMS, INC.

BOA's relationship with VISystems, Inc. as national higher education distributor is designed to provide traditional IBM mainframe users with alternative processing solutions and to complement IBM in the On Line Transaction Processing (OLTP) marketplace. VIS/TP is ported to and currently available on the IBM RS/6000, HP 9000, Data General AviioN, DEC Ultrix, SUN and Motorola hardware platforms and allows exisiting IBM proprietary mainframe applications to run on UNIX platforms in the client/server environment.

BOA will focus downsizing projects for current users of IBM mainframe and plug-compatible systems within the higher education community. BOA will provide system software migration services to clients utilizing VISystems VIS/TP products and assist VISystems with software migration projects for their customers.

CONFERENCE PARTICIPATION

BOA was pleased to be an exhibitor at CAUSE 1992. Many conference attendees stopped by the booth to visit with BOA principals and consultants and to pick up a "sweet treat" and drop their names in the bowl for the drawing on Thursday. The winners of the leather portfolios were **Hilda Au**, Leonard N. Stern School of Business at New York University, and **Carolyn Livingston**, Tufts University. Congratulations to both participants!

THE POWER OF EXPERIENCE

THE SERVICES . . .

BOA combines the expertise needed for today's PROVEN TECHNOLOGIES and MANAGEMENT TECHNIQUES with an IN-DEPTH KNOWLEDGE of the latest automated systems to produce highly functional and adaptive computer based support systems and telecommunications systems to more than meet an institution's daily operational requirements. BOA ensures a successful effort for the client by providing:

- Guidance in the planning process to define the mission, goals and objectives of the client and produce a realistic plan for the future
- Technical review of hardware, software and telecommunications - including video, data and voice
- Experienced administrative assistance and technical expertise in determining the software, hardware and telecommunications needs of the client
- Guidance of the institutional community through the rigors of the needs assessment and procurement processes
- Experienced contract negotiation assistance to provide protected and cost effective installation
- Knowledgable functional and technical project management for coordination and control of the implementation of the selected solution

THE PEOPLE . . .

All of the BOA Principals have been senior level administrative officers at both public and private higher education institutions ** AND ** have held high level positions with major systems provider companies. BOA ensures a successful effort by providing the experience and knowledge acquired by working on both sides of the planning and acquisition process.

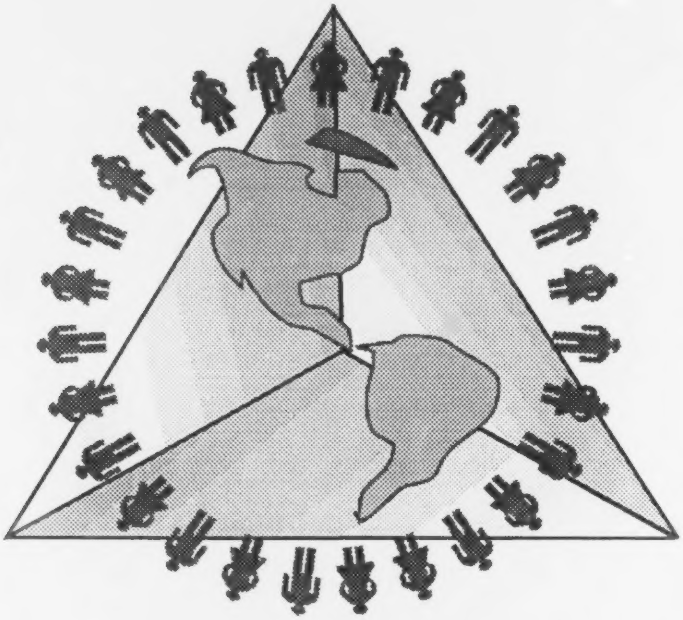
Each BOA Associate is carefully selected to meet the strictest of professional requirements. The BOA Associates have extensive experience in the use and evaluation of educational software, hardware, telecommunications and management techniques. Most BOA Associates have been, or are now, senior administrative officers in educational institutions.

For more information about BOA's services for higher education, please call, fax or write to:

BOA
BOLING, ORAHOOD & ASSOCIATES, INC.
2701 West 15th Street, Suite 508
Plano, TX 75075-7595
Telephone: 214-867-6134 Fax: 214-867-0845

Campus America

World of Learners



Participating at CAUSE92 with the theme *"World of Learners,"* Campus America provided demonstrations of the POISE triad of products (Administrative, Instructional, and Library Systems) showing the conference attendees new and exciting worlds of opportunity for their institutions.

For the seventh consecutive year, Campus America has enjoyed the opportunity to share and discuss software systems with convention attendees who stop by the booth. One of Campus America's foremost goals is continuing to support CAUSE in its efforts to influence the profession of information technology management in higher education.

Campus America's executive office is located in Knoxville, Tennessee. Additional offices are located in Roswell, New Mexico; Merrimack, New Hampshire; Columbus, Ohio; Mobile, Alabama; and Calgary, Alberta.

Campus America
People Oriented Information Systems for Education

900 Hill Avenue, Suite 205
Knoxville, Tennessee 37915-2523
Phone: (615) 523-9506 FAX: (615) 525-5628

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CSS Software Services

The Standard of Excellence in Financial Aid Management Software

CSS Software Services was pleased to attend CAUSE92 in Dallas. We participated by providing an exhibit booth, enabling participants to discuss our array of products. During the conference, the exhibit area was busy and we were delighted to see old friends and to meet so many new participants. The Reauthorization of the Higher Education Act and its impact on our software products and services was the topic on the minds of most participants. CAUSE92 gave us the opportunity to discuss the impending changes and gain insights from our users.

At the booth, we told the story of CSS Software Services and our products and services.

Introduction to CSS Software Services

The administration of student financial aid, in compliance with increasingly complex and ever-changing regulations, requires more specialized computing capabilities than many institutions can develop for themselves. For this reason, the College Scholarship Service (CSS) has developed both microcomputer and special-purpose mainframe software systems to perform support functions for financial aid administrators. Our systems are used by over 1,000 institutions.

AUDITOR, INAS, and PARS
CSS' Special-Purpose Mainframe Systems

CSS' special-purpose systems supplement general purpose financial aid systems and are designed to run on mainframe computers located at your institution or agency:

- **AUDITOR, CSS' Comprehensive Software Solution for Tracking, Verification, and EDE**
- **INAS, the CSS Institutional Need Analysis System**
- **PARS, the CSS Packaging Aid Resources System**

PARS will be completely re-engineered this year to meet our clients' changing needs. A rigorous program of client interaction throughout the development process will assist us in providing a new system, enhanced according to client specifications.

CSS' Microcomputer-Based Financial Aid Management Systems

CSS helps institutions harness the power of the micro-computer to support administration of financial aid at the campus level:

- **MICRO-FAIDS, a comprehensive student aid management system**
- **MICRO-PELL, an automated system to facilitate participation in the federal EDE system**
- **INSTITUTIONAL METHODOLOGY MODULE, a special need analysis module for use with private and institutional funds**
- **MICRO-AUDITOR, an automated system of verification**
- **ISDS, an institutional summary data system**
- **Specialized reporting modules to meet specific state or other reporting needs**

Summary

CSS financial aid software is recognized as the standard of excellence. The mainframe systems have been implemented by more than 400 institutions--and more than two-thirds of those institutions have implemented multiple systems. These systems are used also by major software vendors in the industry, who have developed interfaces to the CSS products and rely on CSS to provide need analysis and other software support. Over 600 smaller institutions and decentralized financial aid operations have implemented MICRO-FAIDS.

Complete lists--not just selected references--of CSS software users are available on request. You will immediately see the names of many nearby institutions that can give you their recommendations about the value and cost-effectiveness of CSS software.

CSS Software Services thanks all pariticipants who visited our exhibit booth. We look forward to seeing you at CAUSE93 in San Diego!

Additional Information

For more information, call CSS Software Services toll free at (800) 227-6734.

CSS Software Services
2099 Gateway Place, Suite 420
San Jose, CA 95110-1017
(800) 227-6734
FAX (408) 452-1725

Dataguard
Recovery Services, Inc.

Dataguard Recovery Services is proud to be a Corporate Sponsor of CAUSE. This year's conference in Dallas, Texas was Dataguard's second national CAUSE meeting. As the premier supplier of Disaster Recovery and Contingency Planning Services for Higher Education, Dataguard was pleased to bring to the forum information pertaining to its experience and expertise. We look forward to continuing and strengthening our relationship with CAUSE and its members.

A NOTE OF THANKS!

You've made us the recognized choice for Contingency Planning in Higher-Education and we'd like to say "Thank You".

- Penn State
- University of Pennsylvania
- University of Connecticut
- Kentucky State University
- Morehead State University
- Northern Kentucky University
- Wayne County Community College
- Rutgers University
- University of Tennessee
- University of Louisville
- Murray State University
- Eastern Kentucky University
- Cuyahoga Community College
- Western Kentucky University

At Dataguard, we maintain our commitment to providing you with a complete range of Contingency Planning Products and Services to meet the needs of your institutions.

COUNT ON US

If you were among those who preregistered for CAUSE92, you received a coupon for yet another unique giveway from Dataguard. (At CAUSE91 we gave away miniature Louisville Slugger® Baseball Bats. Why? Because we're based in Louisville, Kentucky.) This year's giveaway was designed to remind you "to **count** on us to **match** your recovery needs". What was the giveaway? A calculator designed to look like, *what else,* a book of matches.

PRESENTING . . .

Dataguard's own Charles Kendell, Senior Consultant, presented a discussion on "Moving Contingency Planning Beyond the Data Center". Topics addressed included Disaster Recovery considerations for departmental systems, LANS, and PCs. Having spoken at CAUSE91, this was Mr. Kendell's second opportunity to address CAUSE members and their concerns regarding Contingency Planning.

PRODUCTS AND SERVICES:

- **Consulting**
  Dataguard's staff of certified disaster recovery planners can provide your institution with the specific contingency planning services that it requires. These services include:
    - contingency plans
    - risk analyses
    - facility reviews
    - plan automation
    - business impact analyses
    - security and audit reviews
    - communication network recovery plans
    - plan evaluation and update
- **Software**
  Designed by a team of contingency planning specialists, Recovery Architect™ is a menu-driven, PC-based planning tool designed to provide a framework for plan development and ongoing maintenance--the cornerstone to an effective plan.

- **Backup Facilities**
  Alternate-site backup facilities are available. In addition to a completely equipped hot-site to support both IBM and Bull HN (formerly Honeywell) mainframes, Dataguard maintains cold-site facilities, complete with data-communication capabilities and sufficient shell-space to support most data processing systems.

- **Education**
  To prepare a staff for key participation in contingency planning, Dataguard provides education services to ensure an understanding of the goals and requirements of the project. These workshops include management and user awareness seminars as well as preparedness training programs.

- **Training/Awareness Seminars**
  In addition to training classes, awareness seminars are also available. These seminars are scheduled throughout the United States addressing methodology and current trends in the Industry. Informative and topical, they provide an understanding of the issues, components and techniques necessary for the development of a reliable recovery plan.

RECENT ACTIVITIES:

- **Dataguard Completes New Recovery Facility and Headquarters**
  In mid-1992, Dataguard completed construction on a 28,000 sq.ft. Headquarters and Recovery Facility. Over 75% of the building is designed exclusively for the use of Dataguard's client base. Encompassing over 21,000 sq.ft. of customer-dedicated space, the Recovery Center is comprised of a 15,500 sq.ft. hot-site, a 3500 sq.ft. cold-site, a "dark room" processor and disk storage room, a communications network control center, and fully-equipped customer support areas.

  Additional features include electronically-coded card key access, state-of-the-art environmental, security, and power systems, a customer lounge with kitchen, and shower facilities. Just thirteen miles from a major airport, the Recovery Center is situated on two acres of land conveniently located close to numerous hotels, restaurants, retail shops, and entertainment establishments.

- **Dataguard Now Providing IBM Hot-Site Services**
  In the 4th quarter of 1992, Dataguard expanded its business to include recovery services for users of large IBM mainframes. The Company has added an IBM 3090-400E to its backup recovery capabilities. As the only commercially available hot-site for Bull HN (formerly Honeywell) Computer Systems, Dataguard has over eight years of experience in providing backup services to large-system users like General Electric, Honeywell, Air Canada, A. C. Nielsen, and many others.

- **Recovery Architect™ Enhancements Planned**
  Recovery Architect™, Dataguard's PC-based planning tool, will be enhanced for LAN compatibility and multi-plan consolidation. Although current functionality will be maintained, the user interface will change from the current menu screens to Graphics User Interface (GUI) which will support an optional mouse, pull-down menus, and more.

CONTACT: Thomas R. Burke
Vice President, Marketing
Dataguard Recovery Services, Inc.
P.O. Box 37144
Louisville, Kentucky 40233-7144
Tel (800)325-3977/(502)426-3434
Fax (502)426-3028

////DATATEL

"Inventing the We'll"...the focus of Datatel at CAUSE92.

Creating a level of customer satisfaction that is second to none, exceeding your expectations consistently, providing the best in both software and hardware -- **Colleague**, Datatel's fully-integrated administrative software system for higher education, and **Benefactor,** Datatel's fund-raising management system, will deliver. "We'll" means *We Will.*

At each program juncture, Datatel's campaign of what "We'll" do for you rang true...from registering CAUSE92 attendees for our Make-A-Wish Foundation drawing, to talking with attendees about hardware options, to demonstrating our products, to dazzling conference goers with our "CASE Case Study" vendor presentation, to demonstrating our GUI application, to rocking administrators at our karaoke party.

Datatel's announcement at CAUSE92 of its development of a windows/graphical user interface for its Colleague and Benefactor products was very well received by conference attendees who stopped by the exhibit booth to see demonstrations of the GUI product. This is a very exciting time for Datatel and its clients as the implementation of the Graphical User Interface (GUI) front end product will enable Datatel applications users to take advantage of GUI features such as function icons, mouse selections, and pull-down menus.

At Datatel's hospitality suite reception, the theme was "We Will Rock You" where the Buddy Holly lookalike and karaoke filled the suite and created the atmosphere of Datatel's very own "Software Cafe". It was at this party, where Datatel's president, Russ Griffith, announced Carole Warren, Assistant Director for Administrative Systems Development, State University of New York at Albany, and Fred Reiner, Manager, Support Services-MIS, The Johns Hopkins University, as the winners of the Make-A-Wish Foundation raffle.

On December 28th, Datatel presented the Make-A-Wish Foundation with a $1,000.00 check representing two $500.00 donations being made in the names of Carole Warren and Fred Reiner.

Paul Carney, Computer Programmer/Analyst, Datatel, gave a corporate presentation titled "A CASE Case Study". This presentation discussed how institutions with limited budgets and resources can use the advanced technological tools available today with CASE to develop and implement needed applications. During this presentation, Paul Carney described the success of user offices and IS staff working together for rapid development of necessary computer applications; how institutions with limited resources can develop sophisticated systems with CASE tools.

Datatel has been in the computer industry for over 20 years and has provided quality software and services to more than 700 corporate and institutional customers. Datatel expressed appreciation for the relationship they share with prestigious higher education organizations, such as CAUSE, and look forward to future success in assisting colleges and universities in their administrative and fund-raising goals.

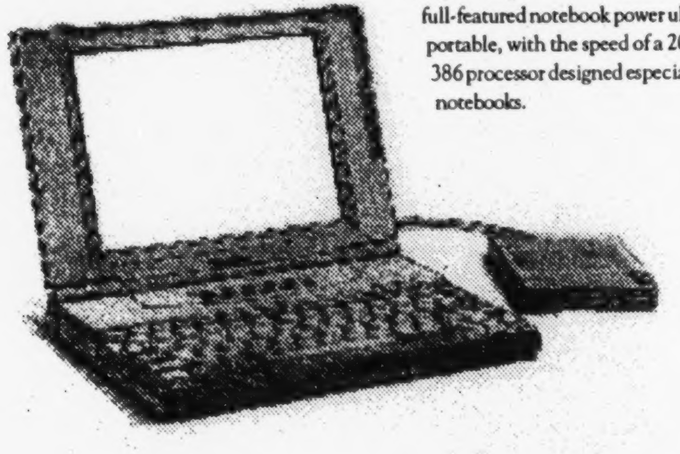
If you would like more information about Datatel and its products, please contact Dr. Laird Sloan, Director of Marketing and Product Planning, at Datatel's Fairfax, Virginia, office (703) 968-4626.

Datatel
4375 Fair Lakes Court
Fairfax, Virginia 22033
(703) 968-9000

DELL AND CAUSE92: AN EVENTFUL INTRODUCTION

THE EVENT

CAUSE92 marked Dell's first year participating at CAUSE, and we're pleased to say that we feel it was a success. Dell Computer Corporation is known within the education community as the company that has risen to the top echelon of the computer industry by providing better computer technology and better services, with reduced costs throughout the entire technology life cycle, and unprecedented guarantees. And CAUSE92 gave Dell an important opportunity to iterate Dell's commitment to meeting the needs of higher education with a flexible approach that covers everything from ease-of-use designed into our computers to reseller programs. We in turn benefitted by having the chance to discuss one-on-one the ways in which we can provide the best possible computers and services to the education community—from students to faculty to administrators. And equally important, Cause92 allowed us to make a variety of new contacts in the education field and to meet with high level adminstrative computing experts to introduce some of our newest and most innovative computer systems.



THE INTRODUCTION

We were excited to have the opportunity to introduce our new computer families to the education field, and one of the key messages Dell brought to CAUSE was that our new line of desktop computers has recently been redesigned to provide higher performance at a lower price. The price/performance ratio of our new desktops is up to 50 percent better than our previous models. Some highlights of the systems we presented:

- Our revolutionary Dell 486/L Series gives you a choice of five low profile i486™ desktops with unprecedented ease of upgradeability and maintenance.
- The 486/M Series improves the popular midsize design that was already the best in the industry.
- The new 486/ME Series makes the advantages of EISA more affordable than ever.
- For the power and versatility of a floorstanding workstation, don't miss the all new ISA-based 486/T Series.
- An entry-level system has never been as easy to use as the new 333s/L, the fastest 386 SX we've ever built.
- At just 3.6 pounds, the 320SLi makes full-featured notebook power ultra-portable, with the speed of a 20 MHz 386 processor designed especially for notebooks.

HIGH TECHNOLOGY SERVING HIGHER EDUCATION

Dell presented some key facts about Dell's position in the computer world and the benefits of our reliability and stability. A tough economy and the current computer "price wars" have caused some computer makers to fall by the wayside. Others have cut back on personnel and features to create lower price lines. Through it all, Dell has continued to build top quality computers. And to add sharp people to serve the education community better. Worldwide demand for Dell computers has helped us break sales records for a remarkable twelve consecutive fiscal quarters. Over the past twelve months, our sales have grown to over $1.64 billion. While others may come and go, we'll be here with you for the long haul—Dell's support and service programs are a famous case in point. Dell pioneered direct relationship marketing in the PC business, and along with it the toll-free telephone support and on-site service that are now so widely imitated. The bottom line: your relationship with Dell puts you in partnership with one of the world's strongest, most stable computer companies.

If you are interested in learning more about Dell and our wide range of flexible, education-related programs, please give us a call at 800 274-7799.

DELL™

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HDS

Hitachi Data Systems

CAUSE92

Hitachi Data Systems is proud to be a corporate sponsor of CAUSE. We are pleased to have participated in CAUSE92 in Dallas, Texas. Hitachi Data Systems came into being on May 1, 1989 and CAUSE92 is our third CAUSE national conference. The people we met were warm, friendly, and a pleasure to talk with.

Our exhibit booth at CAUSE92 highlighted our products and services. Our GX Series of high-performance mainframe computers; HDS 7980-3 and 7390 Disk Storage products; HDS 7490 and 7490E Cartridge Tape Subsystems; HDS 7900 Semiconductor Disk Subsystem; HDS Customer Education Services; HiCare Services, offering the best in professional services; and HDS Customer Service and Support added-value offerings were presented. We further participated in CAUSE92 by hosting the Wednesday afternoon refreshment break. We also provided commemorative acrylic 15oz "kegger" mugs with the CAUSE92 logo and the HDS logo proudly displayed in vivid colors. Again this year HDS provided the pencils for the CAUSE92 registration packets. We also held a drawing for a Hitachi Stereo CD Player system on Thursday. The participation in our drawing was excellent so we will most likely do it again next year. Any suggestions?

Company Profile

Hitachi Data Systems (HDS) was founded on May 1, 1989 when Hitachi, Ltd. and Electronic Data Systems (EDS) joined forces to acquire and expand National Advanced Systems. NAS had established a good reputation for reliable, high quality computer products; a strong marketing force; a well-respected hardware organization; and a highly-skilled Systems Engineering group. Hitachi Data Systems built upon this heritage and was a Billion dollar sales company from its first day. HDS has added 670 new clients in just three years, with 250 of those last year alone. Knowledgeable people who have chosen HDS to satisfy their industry-standard mainframe and storage systems requirements. We've expanded our organization to better serve your needs. We now operate in 39 countries around the world.

HDS, with Hitachi, Ltd. designs, manufactures, sells, supports, and services industry-standard mainframes and storage systems of the highest quality and reliability. HDS is a prominent supplier of high-performance mainframe and storage systems to some of the world's leading corporations in segments as diverse as government, aeronautics, insurance, securities, manufacturing, banking, and of course education.

Hitachi Data Systems currently provides four types of products: mainframes, disk drives, cartridge tape drives, and semiconductor disks. The HDS GX Series of mainframe computers spans a range of processing power to meet the requirements of virtually every user. The HDS GX Series offers users the highest quality and the most flexible range of power, features, and upgrades available in the industry-standard market today. The HDS storage subsystems consist of the HDS 7980-3 and 7390 Disk Storage Subsystems; the HDS 7490 and 7490E Cartridge Tape Subsystems; and the HDS 7900 Semiconductor Disk Subsystem. The HDS storage systems are a complete set of high-performance, high-quality, most reliable storage solutions that attend to every area of your mainframe-based IS computing requirements. And HDS is investing in new directions such as Open Systems, in order to better serve our customers. CAUSE members can gain the competitive edge they need to succeed in today's changing IS environments while being assured of an avenue for rapid growth in the future - an advantage that marks the distinctive, enduring value of all HDS products and services.

HDS Customer Education Services

HDS Customer Education Services offers a new generation of Systems and Applications Training for a new decade of challenges. HDS CES offers comprehensive course curricula that cover the full range of topics in today's computer systems environment. You can have courses customized to fit your needs, also. Choose public courses at any of our HDS CES education centers, or have them delivered on-site. Contact HDS Customer Education Services at 1-800-543-2979 for more information.

For additional information about any of HDS' products and services contact:

Gene England
Hitachi Data Systems
233 N. Michigan Ave. Suite 2606
Chicago, Illinois 60601
312-616-1414

IBM Presents New and Emerging Technologies at CAUSE92

IBM, a corporate sponsor of the CAUSE organization since its inception in 1971, is proud to have participated in the CAUSE92 conference. IBM Academic Information Systems (ACIS) activities at CAUSE92 included:

Exhibits:

- Universal Algorithms, an IBM Business Partner, demonstrated its leading-edge scheduling application for the IBM RISC System/6000.
- Chiefs, an IBM Business Partner, demonstrated its suite of campus safety applications for the IBM Application System/400.
- CMDS, an IBM Business Partner, demonstrated TEAMS 2000, an integrated administrative solution for the IBM Application System/400.
- Software Data Systems, an IBM Business Partner, demonstrated its multi-use campus ID card application for the IBM Application System/400
- IBM demonstrated its new ThinkPad line of advanced technology personal systems.
- Administrators from the University of Virginia showed their use of IBM ImagePlus/2 to implement a LAN-based graduate admissions application using image processing technology.

Workshops:

- Unleashing the Full Power of Desktop Computing with OS/2 vsn. 2.0

Breakout Presentation:

- A Miami University executive presented "Strategic Planning for the Year 2000," describing the use of an IBM services offering to define a campus information systems strategy.

Infomart Presentations:

- Multimedia - Interactive Classroom Technology for the 90's
- Information Sharing with Lotus Notes and ccc:Mail

KALUDIS CONSULTING GROUP

Serving Higher Education

CAUSE92

Kaludis Consulting Group was pleased to co-sponsor the Wednesday morning coffee break at CAUSE92.

Company Profile

KCG is an executive consulting and management services firm specializing in support to higher education. Since its founding in 1977, KCG has assembled a cadre of senior professionals with first-hand experience as executives, administrators, and technical specialists in universities and colleges. KCG consultants have a reputation for strategic thinking, creative problem solving and effective change management. KCG's information technology consulting is focused on helping academic institutions achieve more effective deployment of technology resources in support of improved management.

Involvement in Higher Education

The core of KCG business is service to higher education institutions, executives and governing boards in a broad range of areas: transition support, strategic planning support, organizational evaluation, executive recruitment and search consulting, software and hardware consulting, telecommunications consulting, project management, and interim management. A representative sample of KCG's clients is presented below:

Agnes Scott College
Brandeis University
Butler University
Columbia University
Cornell University Medical Center
DePauw University
Drew University
Gettysburg College
Holy Family College
Indiana University
Inter American University of Puerto Rico
Keene State College
Meharry Medical College
Mount Holyoke College
New York University
North Carolina State University
Northfield Mount Hermon School
Oklahoma State University
Pace University
St. Louis University
Southwestern Baptist Theological Seminary
Smith College
State University System of Florida
Tulane University
University of Alaska System
University of Chicago
University of Evansville
University of Indianapolis
University of Pennsylvania
University of Scranton
University of Texas M.D. Anderson Cancer Center
University of Tulsa
University System of Georgia
Vanderbilt University
Wayne State University

Range of Services

Effective deployment of information technology resources for collecting, storing, analyzing, and disseminating information is critical in achieving enhanced administrative and academic productivity. Prospective students and faculty often evaluate the attractiveness of an institution on the basis of its technological sophistication. The accelerated pace of change in information technology complicated investment decisions. Avoiding obsolescence and maximizing flexibility remain high priorities. KCG brings an essential perspective to information technology considerations--a vision of technological possibilities for academic institutions. That vision is based on KCG's diverse experience, broad capabilities in computing, information systems, networks, and telecommunications; and solid understanding of trends in technology evolution. KCG's support enables clients to "stand in the future" of information technology when making decision. KCG's Information Technology service portfolio encompasses:

Evaluation and Planning
Operations Assessment
User Requirements Analysis
Internal Plan Review
Strategic Plan Development

Procurement and Implementation
Computer/Telecommunications Systems Design
Systems Integration
RFP Preparation/Evaluation
Vendor Negotiations
Project Management

Network Planning/Long Distance Service Analysis
Performance Appraisal
Topology/Technology Design
Cost/Performance Optimization

Specialized Services
Office Automation/Cabling Analysis and Design
Facilities Design/Programming
Interim Management
Executive Recruitment
Evaluation of Business Opportunities

For additional information, contact:

John F. Leydon, Principal
Kaludis Consulting Group
2505 Hillsboro Road, Suite 302
Nashville, Tennessee 37212
Phone: (615) 297-3880
Fax: (615) 297-3884

Periphonics
CORPORATION

PERIPHONICS AT CAUSE

THE FIRST WORD IN VOICE RESPONSE

Today, more than 1,000,000 students at over 90 colleges and universities in Canada and the USA, are using Periphonics' Interactive Voice Response (IVR) technology to improve services to students while reducing labor costs. Total student enrollment for these institutions range in size from 1,000 to 55,000 students including community colleges, junior colleges, technical institutes, colleges, and universities.

Interactive Voice Response (IVR) technology can automate many kinds of inquiries and transactions that take place over the telephone. Typical college and university student transactions that may be automated with IVR include: course enrollment/registration, fee payment via credit card, admission status inquiry, bulletin board announcements, financial aid status, grade reporting, name/address changes, and incoming phone call routing. IVR can also automate a variety of administrative tasks such as student housing assignments and ordering supplies.

A HUNT FOR TREASURE

You may remember waiting anxiously on line to try your luck at opening the lock on Periphonics' treasure chest. We're proud to announce that we had three lucky winners. A Tiffany clock and two Mont Blanc pens were among the treasures. Thank you all for stopping by to give it a try.

HOSPITALITY NIGHT

Over 500 CAUSE attendees visited with us on hospitality night. If you hear of anyone raving about the smoked salmon, you can be sure they were talking about Periphonics' menu. Or were they talking about Periphonics' menu-driven application generator, Peritalk that was demonstrated?

4000 Veterans Memorial Highway • Bohemia, New York 11716-1024 • (516) 467-0500 • FAX: (516) 737-8520

CORPORATE PRESENTATION

"Voice Processing Technology in Higher Education"

George Cole, Periphonics Vice President of Marketing, focused on the uses and benefits of voice systems today in higher education today. Departments who make use of voice technology are registration, admissions, financial aid accounts receivable, student/business administration. The potential applications were described in detail. The benefits of implementing voice systems include cost savings, higher levels of service, and new automated services that were never before available. A major portion of the presentation covered the design and development of applications.

CORPORATE SPONSORSHIP

Whenever you refer to the notes you took at CAUSE '92, we hope you'll remember Periphonics Corporation on each page. Look back!

ABOUT PERIPHONICS

For over twenty years, Periphonics Corporation has been a leading supplier of voice processing systems for interactive voice response and audiotex applications. Periphonics has specialized in voice processing systems and stands behind every system installed. Nationwide service is provided, ranging from routine maintenance to 24 hour support on site. Support and service complete the Periphonics product line.

CORPORATE CONTACT:

Karen L. Ferraro, Marketing Manager
Periphonics Corporation
4000 Veterans Memorial Highway
Bohemia, NY 11716
(516) 467-0500

PINNACLE
PINNACLE SOFTWARE CORPORATION

CAUSE '92 NATIONAL CONFERENCE
Dallas, Texas

Pinnacle Software Corporation specializes in the development and service of administrative and telecommunications software solutions for higher education. Pinnacle is a company of 18 experienced people located in Rochester, NY. David E. McKelvey, Richard J. Lines, and Philip A. Cooke are the founders of Pinnacle. The founders are former officers of Information Associates, each with over 20 years of experience in providing software solutions to higher education. Each employee either has held positions in higher education or has extensive experience in serving the needs of higher education. Pinnacle is currently servicing over 40 higher education customers. A representative sample list of Pinnacle customers include Tufts University, University of North Carolina at Chapel Hill, University of Arizona, and the University of Colorado. The services provided to these universities include product telephone consultation, defect resolution, consulting, enhancements, and federal regulation updates to the software.

In April 1992, Pinnacle acquired software rights to Softlogic Communications, Inc., telemanagement products. Paul Bolz, President of Softlogic has joined Pinnacle with the responsibility for the success of these products. Pinnacle has five years of experience in providing telecommunications solutions to higher education and has successfully implemented telephone and cable management product solutions at a number of institutions. Included with these implementations, are successful integrations with PBX's supplied by Northern Telecom, Ericsson, and ROLM.

The Pinnacle Booth

At this year's conference, Pinnacle demonstrated its AXIS Telemanagement Software, PC70 Report Writer, and PC Financial Query. Below is a brief summary of each product.

AXIS Telemanagement System

With AXIS, you can turn your telecommunications department into a profit center while providing your students and administrators with a cost-effective long distance telephone service.

Pinnacle offers a comprehensive telecommunications management system that may be installed in two separate modules. The first module is our Telephone Manager System which is comprised of toll rating, discounting, billing, accounts receivable, and traffic analysis. Our second module is our Facilities Manager System which is a wire and cable tracking system which includes cable entry, cable availability inquiry and work order, and trouble ticket processing. They can be implemented separately or together. When run together, the two systems interact to provide you with complete access to information and eliminate the need of updating two separate data bases.

PC70 Report Writer

Offered for the first time at last year's SCT FAS/FRS Users Conference, PC70 Report Writer makes financial reporting seem effortless. PC70, under Windows, runs on your PC avoiding mainframe constraints and allowing for annotations customized to fit your unique needs.

PC Financial Query

Introduced at this year's SCT FAS/FRS Users Conference, PC Financial Query extracts financial data from the IA-Plus and IA-IDMS database allowing you to view it on your PC. Adhoc reporting can now be easy and efficient!

Focus on CAUSE92

Quodata®

digital Cooperative Marketing Program™

Quodata was pleased once again to actively participate in CAUSE92. Dallas was a great place to develop and renew relationships. Many CAUSE members stopped by to discuss Quodata's updated PC Connection, the new Screen Management System with DECforms, and standards in software. Quodata and Digital are committed to software standards which improve integration, lower costs, and increase software life.

☐ The Company

Quodata was founded twenty years ago to provide the finest computer software and service to educational institutions. The company focuses on smaller to medium-size members of the higher education community with an array of administrative software systems which gives users greater flexibility.

Quodata joined with Digital Equipment Corporation in 1971 to provide administrators with the benefit of Quodata's expertise in software and service, plus Digital's leadership in technology. Quodata was Digital's first Systems Cooperative Marketing Program (SCMP) member for administrative systems in education.

☐ The Software

Quodata is one of the first companies to make a major investment in following industry standards. Today Quodata can demonstrate an array of integrated products running on a relational platform. This architecture includes not only a relational database, but also a structure in which extensive changes can be made to an application system without modifying the source programs. Quodata's software family of integrated products includes:

- admissions and recruitment
- billing and accounts receivable
- financial aid
- financial reporting
- institutional advancement
- payroll and personnel
- student information and degree audit

These products are all built with the same flexibility and integrated database structures. Changes to a wide variety of control files, collectively called libraries, make these systems extremely versatile. Users are free to change table values; add table elements, files, new logical views, or even entire databases; create or modify menus, video screens, reports, and command procedures; and even create new relationships between existing or new databases.

(con't)

One very important benefit of this structure is that a new version of the software does not override changes to the existing version. Generally only a minor effort is necessary to add enhancements to the tailored libraries. No other software handles updates as easily as Quodata's new relational software architecture; **it is designed for change**.

Quodata's software architecture adheres to Digital's VAX/VMS operating systems architecture and Networked Application Support (NAS) software standards, which Digital exhibited at CAUSE92. Quodata believes that no one software company can fill all the administrative needs in higher education, and a standard platform simplifies access to other products and personal workstations. Quodata's software functions well within a distributed network, multi-platform environment.

☐ The Services

Even the best software is of little value without the right support. Quodata takes great pride in providing excellent service. Proof of its quality is the 96 percent software service contract renewal rate for Quodata clients over this past year. The most important commitment is to hiring capable, service-oriented people with experience in educational institutions.

Most clients move from an existing computer system to the Quodata system. Sometimes there are features users have or want which are not part of the standard system. The flexibility of Quodata software means that making these modifications is unusually easy, *without programming*. However, someone must analyze the situation, determine the best way to effect the change, and modify the parameters in question. Many clients have capable computer staffs, but not enough time. Quodata offers such users additional implementation options. Essentially, Quodata personnel will perform many of the tasks necessary to get the institution up and running.

☐ The Users Group

A great deal can be learned by sharing information with peers at meetings like CAUSE92. Quodata actively supports and encourages its users groups. An annual conference is held each Fall. Sharing is further promoted regionally and through newsletters.

Sigma Systems, Inc.

New Technologies, Emerging Standards, Integration, Multi-Platform Applications, Total Quality Management Strategies, Enterprise-wide Information Systems, Downsizing, Client/Server Technology. These were all topics of concern and discussion at the CAUSE92 conference in Dallas this year. And Sigma Systems, Inc. was proud to be a corporate participant. Sigma is a leader in student financial services systems and implementation services, and our staff were pleased to discuss our strategies on these and many other topics with current and prospective clients, colleagues and vendors.

As an exhibitor, we demonstrated our various software applications specialized in the area of student financial services and our Integration Shell^{tm} which connects not only our applications to each other, but our applications to your applications. Our purpose was to demonstrate how to have the best application system for each mission critical function for your institution with dynamic data access throughout the application systems.

CAUSE provided an excellent, action-packed program and in case you did not have an opportunity to stop by our booth, or you would like additional information, our systems include:

SAM	The Student Aid Management System
LAPS	The Loan Application Processor System
SARS	The Student Accounts Receivable System
TADD	The Table, Audit, and Data Dictionary System

Please contact Sigma Systems, Inc. at:
650 South Cherry Street, Suite 1035
Denver, Colorado 80222-1812

Voice: (303) 329-3626
Fax: (303) 329-3708

SCT

Featured *A Spectrum of Choice* at CAUSE92

Systems & Computer Technology Corp. (SCT) is a leading provider of administrative software and computing management services for higher education institutions worldwide. During CAUSE92, SCT featured *A Spectrum of Choice* in advanced administrative product and service solutions.

Highlighted at the conference were SCT's software products. First, was the **IA-Plus™** Series, a choice for institutions operating in IBM or DEC VAX mainframe environments. In an IBM environment, IA-Plus is also available using the DB2 relational data base. DB2 offers excellent performance and response time, while providing access to data with SQL. Also featured was the **BANNER®** Series of advanced software, offering five fully integrated systems based on the industry-leading ORACLE relational data base. BANNER is the first administrative software for higher education designed to operate in a true client/server environment. Attendees visiting the SCT booth had the opportunity to see a demonstration of **EDI.Smart™**, an advanced electronic data interchange product, and **IntelliQuest**, a natural language query system to BANNER software. SCT and Digital Equipment Corp. both featured a Graphical User Interface (GUI) to the BANNER Series. The GUI was developed by Reed College.

Completing the SCT spectrum was **OnSite** services -- SCT's strategic computing management alternative. An OnSite partnership provides a full range of information resource management services to help colleges and universities make an affordable transition to state-of-the-art technologies.

It was standing room only for SCT's Corporate Presentation, **"Providing a Spectrum of Solutions for Diverse Higher Education Clients."** Michael J. Emmi, Chairman and CEO, introduced the "new SCT" with a multimedia presentation featuring three BANNER clients and two IA-Plus clients. Each client described how they face today's administrative challenges using innovative management techniques, BANNER and IA-Plus software and professional services from SCT, as well as a clear vision of their future. A special "future" segment portrayed the way in which a student might register for classes in the year 2008. The segment received an enthusiastic response from the audience.

SCT's impressive array of solutions was presented in an exciting way via the magic of Giovanni. Visitors to the SCT display and hospitality suite were kept spellbound by Giovanni's array of entertaining sleight of hand.

SCT: A Dedicated CAUSE Sponsor

ELITE Award ... For the first time, SCT sponsored the ELITE Award, recognizing an outstanding individual from the higher education community for Exemplary Leadership and Information Technology Excellence. SCT was pleased to sponsor this year's award to Bernard W. Gleason, Jr., Executive Director of Information Technology at Boston College, in honor of his two decades of technological problem-solving.

CAUSE/EFFECT Award ... For the 11th consecutive year, SCT sponsored the CAUSE/EFFECT "Contributor of the Year" Award, presented to the author of the article judged to be the best of all contributed papers published in the quarterly *CAUSE/EFFECT* magazine during the prior year. Please join us in congratulating this year's winner, Gerald V. Bernbom, Assistant Director of Data Administration and Access at Indiana University. His article, "Data Administration and Distributed Data Processing," appeared in the Winter 1991 issue of the magazine.

Golf Tournament ... SCT was once again proud to sponsor the CAUSE Golf Tournament with prizes for the Men's and Women's Low Scores, Longest Drive, Shortest Drive and Closest to Pin.

Telco Research

Telco Research Corporation

Reengineering Communications Management Solutions through Client Server

During its eighteen year history, Telco Research has consistently been committed to developing and delivering the highest quality of telemanagement products and services. Telco Research is the only telemanagement vendor whose products span three different platforms- Personal Computer/DOS/LAN, mini- and mainframe, and client server.

Our CAUSE presentation consisted of the application requirements of a communication and telemanagement system, telemanagement trends, and the industry's response to the trends.

Background

In the past few years, the traditional higher education telemanagement solutions are being challenged. Many institutions are demanding additional capabilities from their telemanagement and communications systems in areas such as resale, premises distribution networks, equipment configurations, flexible and interoperable databases, and real-time interfaces to subsystems. Today's telecommunications and information infrastructures, often consisting of voice, data and video applications, are causing fundamental changes in the way work is performed.

Through audience participation, it was determined that institutions are in search of a solution of comprehensive and scalable applications that operate within the context of relational and flexible communications environments. This solution should handle the traditional telemanagement and resale functions, as well as the management of the premises distribution network, terminating equipment configurations, and real-time interfaces to other subsystems. These applications should be able to function either independent of each other or as a modular, integrated system.

The underlying architecture of these applications would serve institutions well if it were based on a client/server model and utilizing Windows™ 3.x clients attached to a UNIX-based server. This architecture must be compatible with the most widely used LAN topologies. Residing on the server would be ASK Ingres relational database engine, end user tools, and networking support.

The underlying architecture must be able to organize and define how each subsystem communicates. The system must support the following applications: configuration management, change management, accounting management, directory, data collection, performance management, and problem tracking. Imbedded in the architecture should be the interprocess communications standard and database architectures required to support the applications subsystems. Administrative and security utilities should be standard components of the system.

Application Requirements

1) Configuration Management: Provides a single point of entry for any change affecting the environment which includes all desktop devices (voice and data), peripheral hardware, wiring and cabling facilities, intra-network and inter-network arrangements, software, circuits, a variety of terminating equipment, PBX real estate and/or end user services.

2) Premises Wiring Administration: Voice, data and video communications equipment and associated information are maintained in a common database. Provides end-to-end tracking of enterprise cable plants. Supports multiple cabling topologies, service types, and media types. A complete inventory is maintained including a predefined library of cables, crossconnect, interconnect, and equipment that can be modified and changed. Provides budgetary information and a standard cost allocation interface.

3) Problem Management: Provides the ability to register track and dispatch problems for conditions detected and reported by end users, as well as those conditions detected by external monitoring subsystems as they pertain to communications services and facilities. Provides historical view of performance by maintaining a history of problems. Provides an import capability for the inclusion of foreign data.

4) Accounting Management: Provides the facilities for the measurement, allocation, verification and budgeting of costs associated with the communications services and facilities. Interfaces with Change and Configuration Management and Premises Wiring Administrator, and Problem Tracking system of the communications environment. Facilitates administrative, student resale, grant administration and tenant resale.

5) Change Management: The basis of this module is to facilitate the service order process. It will provide facilities for registering, planning, designing, assigning, and tracking changes and work load balancing. Provides standard and ad hoc query capabilities for reviewing upstream and downstream service paths.

6) Directory Management: Facilitates the tracking of information about end users, organizations, and services for the purposes of queries, publishing, and cost allocation. Provides an enhanced attendant search and reporting capability for rapid access and publishing of directory entries.

7) Performance Management: Provides a statistical view of the operation of the various components of the communications environment.

Administration Toolkit: Comprised of a set of utilities supporting ad hoc queries and reports, security administration, and operation related functions.

Security Administration: Provides a system administration shell for operations of the server environment. Multi-level security subsystem enabling user profiles to be established by subsystem.

Industry Reaction

The audience's primary questions pertained to what vendors if any have or are developing the applications and architecture needs that were discussed in the presentation. To date, Telco Research is the only vendor that has a comprehensive solution on a client server platform.

Summary

Telco Research's goal is to be an important resource which drives the telemanagement process rather than a vendor that only reacts to competitive change. Our maxim is to develop and implement products and services that have an applications foundation - not to simply implement technology for technology's sake. Our products and support services are not only used for operations, but also as a tactical and strategic resource that assists management in utilizing the telecommunications and data communication functions as integral components in actualizing the strategic agenda of an institution.

For more information about Telco Research's Products and services for higher education, please call our toll-free number, or write to:

Telco Research Corporation
1207 17th Avenue South
Nashville, TN 37212

Or call
Toll-free (800) 48TELCO
In Tennessee, (615) 329-0031

1992 CAUSE National Conference
Corporate Presentation Summary
The Robinson Group, Ltd.

"Grasping the Momentum of the Information Age," the theme of the CAUSE 1992 National Conference, is a theme that The Robinson Group, Ltd. ("TRG") followed in its pre-conference workshop, corporate presentation, and corporate exhibit.

The pre-conference workshop, entitled,"Network-based Instructional Support for Faculty Workshop," addressed the change process for faculty. Ms. Jan Baltzer, Director of Computing and Communications at the Maricopa Community Colleges, and Dr. Judith Leslie, Vice President of TRG, made presentations regarding the change process. Ms. Baltzer related the principles of change management in the literature to specific examples of change within the Maricopa Community Colleges. Ms. Baltzer described various network-based instructional projects that faculty had originated and discussed a number of issues encountered when moving into the new environment. Dr. Leslie spoke of the changing paradigm for faculty by comparing the differences in the past academic environment with the emerging academic environment. Dr. Leslie described the use of technology to change the curriculum, teaching methodology, instructional support, classroom, learning resources, and institutional environment. Ms. Debra Harper, Coordinator of Telecommunications at Central Piedmont Community College, shared her perspectives on the process of change for faculty at Central Piedmont as they planned for and implemented The TRG faculty support system, TRG-INFORM. Ms. Harper discussed the issues related to a changing organizational environment and stressed the importance of faculty champions to serve as catalysts for change. Mr. Colin Ikei, Professor of Computer Science at East Los Angeles Community College, spoke of his role as a change agent when he served as Executive Secretary of the AFT College Guild for the Los Angeles Community College District and facilitated becoming a TRG partner institution to implement TRG-INFORM. The workshop concluded with small group discussions of strategies that the participants are using in their institutions to facilitate faculty's "Grasping the Momentum of the Information Age."

Dr. Leslie delivered the TRG corporate presentation entitled, "Linking: A Strategy for the Nineties." She began with a review of the issues facing higher education institutions and linked these issues to the following four strategies: (1) conservation, (2) creativity, (3) communication, and (4) collaboration. Dr. Leslie then explained how TRG solutions supported these strategies to address the issues of higher education.

Dr. Leslie introduced the TRG:INFO-LINK Line of solutions. The first solution presented was TRG-INFORM, a faculty support system. This system conserves the existing student record system data by extracting student information and incorporating that information into INFORM for use by faculty. INFORM is a system that automates faculty record keeping, thus allowing them more time for developing creative instructional approaches. INFORM facilitates communication between faculty and students with an electronic messaging component and the capability to automatically generate progress letters to students. INFORM is a solution that has been collaboratively developed and implemented. A number of leading community colleges, the League for Innovation, IBM, and TRG are participants in a national project to evaluate INFORM and develop guidelines for a faculty support system that can be shared with all higher education institutions.

The second solution introduced was TRG-INSIGHT, a program assessment and student tracking system. INSIGHT conserves existing data by extracting data from a student record system and incorporating the data into INSIGHT for longitudinal tracking of student retention and success. INSIGHT facilitates creativity with its flexible reporting capability that allows users to perform a variety of cohort analyses. INSIGHT strengthens communication between students and advisors because of the continuous advising record that INSIGHT maintains and through the targeted mailings to students. INSIGHT also supports multi-institution communication through the sharing of information from K-12 to community college to university for longitudinal tracking of students. INSIGHT is part of a collaborative project with The American Council on Education's Program called the National Center for Academic Achievement and Transfer who, along with the Ford Foundation, sponsored the implementation of INSIGHT at two pair of institutions, a university and a community college, to assess the effectiveness of the transfer program.

The third solution presented was TRG-INFACT, an on-line electronic almanac. INFACT conserves existing data by accessing data from administrative systems and making it accessible from the desktop in summarized graphic and spreadsheet format. INFACT allows the user to be creative in developing views and manipulating information, doing so on the desktop using graphing tools. INFACT facilitates communication among administrators in planning and decision making because they all have access to the same, consistent, and accurate information. INFACT has been developed collaboratively with a number of institutions and will continue to evolve in its capabilities through the efforts of the partner institutions.

The fourth solution described was TRG-INTONE, a software and services solution that provides voice response capability. INTONE conserves existing information resources since it accesses an existing student record system. INTONE allows institutions to be creative in identifying a variety of applications for which a voice response application can be developed, as TRG has done with several institutions. INTONE facilitates communication with students given the familiarity of today's students with telephone access to services and the convenience of 24-hour access. TRG and select partner institutions have collaboratively developed voice applications.

The fifth solution presented was TRG-INTOUCH, a campus information system. The strategy of conservation is apparent with INTOUCH, since the software gives students secured access to the existing student record system. Institutions can use INTOUCH in a variety of creative ways such as multi-media presentation of information. INTOUCH facilitates communication with students through such capabilities as a faculty/staff directory, multi-media orientations, and on-line counselor, expert system. INTOUCH has been collaboratively developed with partner institutions.

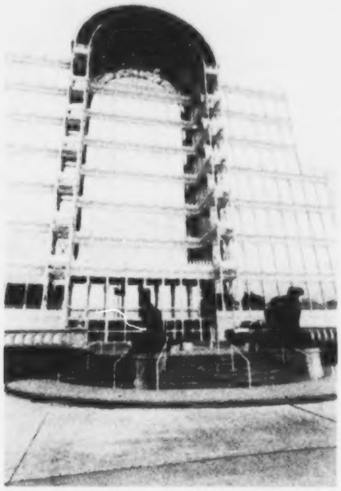
The sixth and final solution presented by TRG was TRG-INVOLVE, professional services. TRG consultants with extensive experience in applying technology to higher education assist institutions conserve existing resources through the migration planning services offering. TRG consultants creatively work with institutions to jointly develop new applications. TRG assists users within an institution communicate with each other by using a SAGE Readiness Analysis approach to all of its projects in which steering committee members meet to form project mission, goals, barriers, strategies, and action plans. TRG works collaboratively with its partner institutions and with its business partner, IBM, in a number of ways including joint design and development of products and services and through such activities as partner seminars and conferences.

TRG also participated in the corporate exhibit with its Southwestern booth where all the TRG INFOLINK line of solutions were featured. For more information please contact the following TRG representative:

Maureen Nadeau, Marketing Representative
2411 West 14th Street
Tempe, Arizona 85251
(601)731-8900

Post-Conference Session

Ask the Experts at INFOMART



The Dallas INFOMART is a unique showplace for advanced technology, with sophisticated presentation suites for resident corporations. A number of the INFOMART corporations serving higher education participated in a special program for CAUSE92 conferees. Approximately 150 conferees took advantage of this first-ever post-conference offering.

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CAUSE
92

A PICTORIAL REVIEW OF CAUSE92

An abundance of conference program options, Dallas sunshine, and the stunning Loews Anatole Hotel art collection greeted the record 1,410 CAUSE92 registrants at the 21st annual CAUSE conference. The pictures on the following pages are presented as a reminder to participants of the variety of good times and opportunities for professional growth that they enjoyed last December in Dallas.

Corporate participation ...

Corporate contributions to CAUSE92—logistical and technological support, sponsorships of social events, professional presentations and exhibits—were an integral part of the conference experience.

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Welcome
CORPORATE
DEMONSTRATION AREA
REFRESHMENT BREAKS
POSTER SESSIONS
Welcome
CAUSE 92
CAUSE 92

Wall of Fame
Alpha AXP

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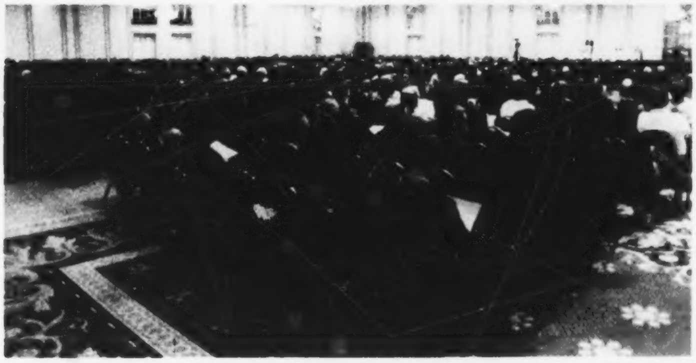
Formal program

CAUSE92
CONFERENCE REGISTRATION

A meeting of professional colleagues from around the world, CAUSE92 featured sharing of expertise, recognition of individual achievement, and the annual change of association leadership.



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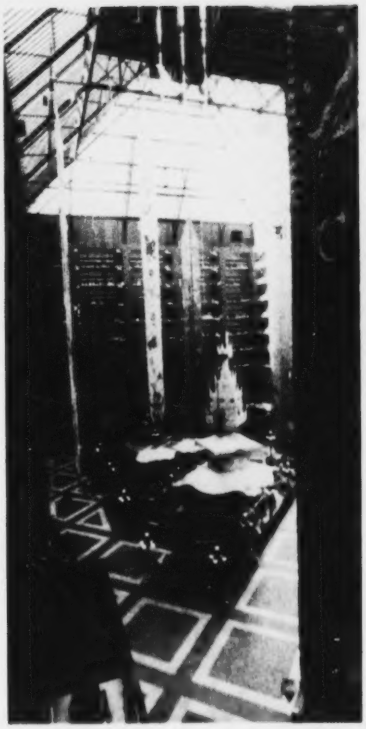

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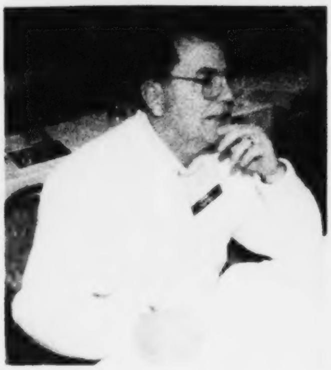
In session

One-on-one or one-on-1,000—CAUSE92 sessions encouraged a range of formats for professional interchange, from lecture-style presentations to group discussion, to unstructured poster sessions.



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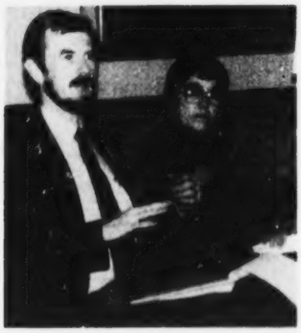

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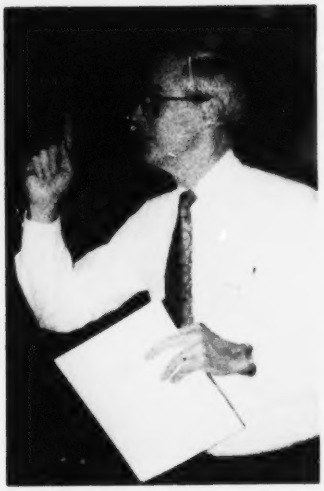

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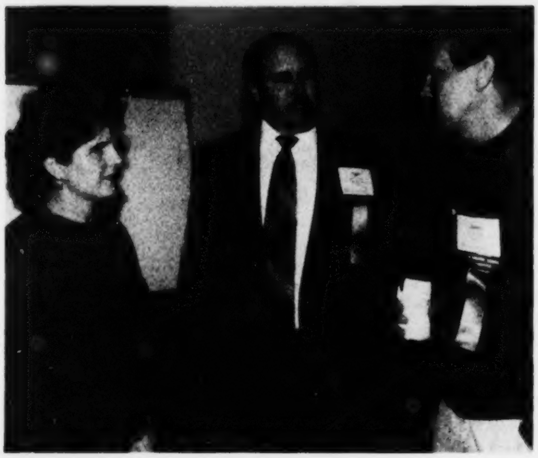
Networking...

In their CAUSE92 conference evaluations, attendees ranked networking with colleagues as the most important factor in their decision to attend—even above program content. Advice to first-comers stressed the importance of meeting new people; informal comments to conference organizers complimented attendees on being approachable and interested in sharing ideas.



Message Center
Information and Messaging Center

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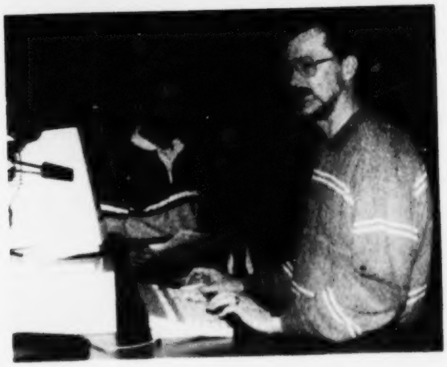
and Sharing Ideas



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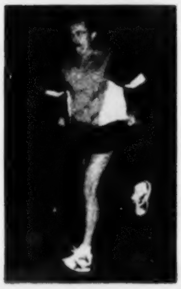
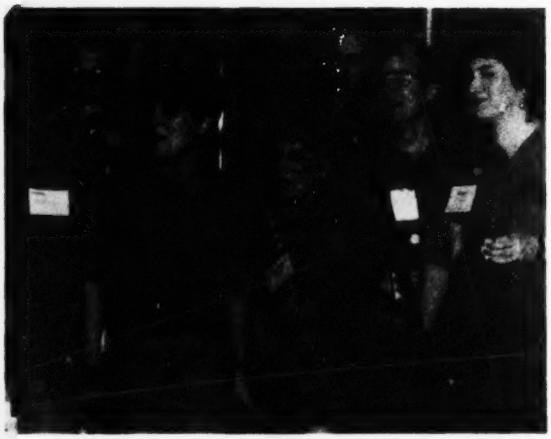
and time for fun...





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Summary of CAUSE92 Conference Evaluation

329 Evaluation Forms turned in

1. Rate the following CAUSE92 activities in terms of their value to you:

	Very Valuable	Somewhat Valuable	Not Valuable	No Opinion	Did Not Attend or Use
General Sessions	58	68	2	0	0
Negroponte	150	146	15	1	9
Barone	205	74	4	0	36
Ross	88	106	19	3	36
Current Issues Forum	86	102	11	2	49
Track Sessions	193	115	0	0	0
Current Issues Sessions	104	106	4	11	62
Constituent Groups	82	97	11	15	97
Special Interest Groups	53	78	6	24	124
Campus Perspectives	73	90	5	20	104
Special Sessions	31	43	6	22	178
Poster Sessions	31	109	21	24	118
Communications Central	89	58	5	28	111
Corporate hospitality suites	63	145	39	23	47
Corporate presentations	101	175	8	5	30
Corporate demonstrations	129	144	9	6	25
Colleague interaction	279	34	0	1	4
Conference newsletter	120	160	20	13	5
CAUSENet Messaging System	187	86	11	9	20
Print-on-Demand Papers	105	48	10	13	124

Other:

- Pre-conference seminar - Very Valuable
- Would have liked to print my email
- CAUSE resources throughout the year - Very Valuable
- Picture Directory - Very Valuable
- Meals - terrible
- New member breakfast - Very Valuable
- Video highlights - Very Valuable

2. What made you decide to attend CAUSE92? Please indicate how important these factors were to you.

	Very Important	Somewhat Important	Not Important
Program content	216	66	4
Conference location	38	108	159
Peer recommendation	111	90	83
Identification with CAUSE	142	118	39
Networking with colleagues	256	58	3
Corporate demonstrations	68	177	52
Professional development	250	50	7

Other:

- Session Participation
- Program Committee
- History of what I've learned from past conferences
- Board involvement
- Money finally available
- Told I must investigate in-house administrative computer systems

3. Do you think anything you learned at CAUSE92 might have an effect on the way you do things at your institution? Yes - 232 No - 12 Maybe - 1

If yes, please explain:

General:
Many lessons/ideas to take back - 40*
Too many ideas to specify - 5
New perspectives - 13
Networking with colleagues - 12
Recognized that my school is not unique - 4
Reinforced commitment to stick to directions we are currently taking - 15
Reinforced need for change - 11
Vendor help - 5
Information on future trends - 5
Ideas from Carole Barone's session - 4
Ideas from Nicholas Negroponte's session - 2
Gartner Group presentation - 1

Specific:
Information on client/server environment - 35
Strategic planning - 21
Affirmation that role of central IS has changed - 14
Campuswide network plans (and applications of Internet) - 12
TQM issues - 12
Increased customer support and involvement - 11
Importance of team building - 5
IT integration into the classroom - 4
Structure and practices of data administration - 3
Disaster recovery - 3
Internal staff training program - 3
EIS/DSS - 3
GUI (Graphical User Interface) - 3
ID card - 2
Help in getting senior level support - 2
Ethics and security - 2
Will introduce more humor
Rightsizing
Role model as exemplified by ELITE Award winner (Bernie Gleason)
Raise level of institutional awareness of IT
Need to take management risks to be effective
Combining academic and administrative computing
Advocate our interaction with K-12
Network security
Access to Bitnet
PBX
Enrollment management model application
"Prism" software on DEC
PeopleSoft Payroll/HR system

*indicates the number of times the comment was made

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4. What topics/speakers would you like to hear at future conferences?

Topics:
Networking - 22 including:
    Integration of voice, data & video over networks
    Networking 101
    Purely technical presentation with types of networks and pluses and minuses
Client/server (with case studies) - 21
TQM - 11
Ethics and security - 7
Organization change issues - 5
Managerial development and issues - 5
More small to medium college sessions - 5
Data administration and data as a resource - 5
Same types of topics as presented this year - 3
GUI (Graphical User Interface) - 3
Strategic Planning (on-going and how to accomplish) - 3
Strategies for team building and self-management - 3
Distributed system strategies and components - 3
Administrative computing - 3
More creative, interactive sessions like Odyssey presentation - 2
Reengineering - 2
Information resources management concept - 2
Image processing - 2
Data warehousing - 2
How to assess the impact of the IT investment - 2
Some experiences that were failures - what not to do - 2
Image Processing - 2
Emphasize integration of systems rather than development of systems - 2
Role of the library in this information society - 2
Implementing/managing open systems - 2
Faculty involvement in information technology - 2
User services - 2
CIO - dying or still emerging?
Service delivery to students
Information architecture (institution-wide)
More "what we did to get started"
Tutorial track with basic information (on CWIS, TQM, etc.)
Facilitation of software re-use
User-modifiable systems
A library representative with the libraries' "vision"
RAD (Rapid Application Development)
Standards in a heterogeneous environment
Information engineering, not reengineering
Broader perspective on financial systems
Cost cutting "creative" financial solutions
Financial strategies (other than grants) for acquiring significant projects and investments
Funding/chargeback models for computing in higher education
Management of technical personnel
Document Imaging
Help in structuring/evaluating instruments for obtaining customer assessment of quality
Migration from a network database structure to a relational structure on a mainframe
CASE
Dealing with change
Re-training staff for emerging technologies
Supporting instruction with multimedia and other technologies
Introduction to Information Science for IT professionals
Strategies for convincing top administrators to invest in automation training for PC users

Training strategies for moving campus culture in the IT direction
Dealing with new forms of data and navigating the vast networks of data
Information/document retrieval systems
Documentation to keep up with changes at large public institutions
CNI - overall status and in-depth coverage of 1-2 projects
Vendor negotiations

Speakers:
Futures oriented speakers - 7 including
    Economic futurist; Technical futurist
Reality oriented speakers (rather than fanciful dreamers)
At least one non-computer oriented person for the keynote slots

Carole Barone or more like her - 7 including:
    Carole Barone and how she's implementing her ideas
Grey Freeman - 4
Peter Senge - 2
TQM guru like Crosby
DeBono - creative thinking
Joel Barker - paradigm shifts
Brian Hawkins
Lester Thurow
Bill Gates
Fred Hofstetter
Steve Cook
Ken Blythe
James Martin
Jim Bruce
Gene Sherron
Brad Stone
Negroponte

5. Are there any corporations that you would like to see participate in future conferences?

It was a good cross reference; keep up the good work - 15
More IBM participation; not just their partners - 3
Vendors of application software that runs on distributed platforms
Application development companies
Client/server products
More networking
Covey Institute for Principle Centered Leadership
Case vendors
    Knowledgeware - 3
    Bachman - 2
    Brownstone
    NLI

Microsoft - 8
Sybase - 4
Novell - 2
Cabletron - 2
SCT
OSF
Uniface
Brio Technology
Informix
Sun Microsystems - 7
Ingres - 4
Northern Telecomm - 2
Unidata/Universe
Data Prism
CCA Consulting
Power Builder
Andyne
ROLM
NeXT - 6
Oracle - 2
Amdahl - 2
Data General
Transare
ASK
Parc Place
SRI Consulting
Dynix
AT&T - 5
Cognos - 2
Notis - 2
Uniface
GTE
CA
Boreland
Unisys
VMark (Pick databases)
AST (terminal emulation and file transfer products)

6. Do you have any comments about the site of CAUSE92?

Great, excellent - 81
Good, very nice - 48
Adequate - 3
Poor - 2
Hotel too isolated (too far from downtown Dallas) - 25
Like inclusive nature (everything under one roof - including entertainment) - 7
Vendors were too far away - 13
Hotel was too cold - 10
Need a more physically attractive site (ocean resort) - 2

Worst food in years - 2
Best food in years - 2
Too expensive - 2
Would like to see alternative of cheaper hotels
Dallas is a good and convenient location - 14
Dallas is too cold in December - 9
Dallas is not a draw (like an ocean resort) - 6
Hawaii - 2
Las Vegas
Cruise ship

7. What CHANGES would you like to see in future conferences?

None - 17
More convenient location of vendor area - 10
How to meet peers - 8 including:
    Signs on tables at meals for "singles," "small colleges," etc.
    Birds of a feather sessions/socials
Forty-five minute sessions were too short - 6
More CAUSENet stations - 5
Some repeat sessions - 4
More break time - 4
More time or fewer tracks - 4
Institution name on badges should be larger - 4
Exhibit area open longer (during sessions and evenings) - 4
Give handouts at sessions - 4
More diversity among track presentations - 3
Change timing to make Saturday overnight stay easier - 3
Add a technical track - 3
More provocative, dynamic general session speakers - 2
Better computer projection systems - 3
More track presentations on small colleges - 2
Community College track or more CC presenters - 2
More track presentations on libraries
Track on service delivery
Expand time allotted for campus perspectives
More demos of institutional implementations
Indicate level of audience expected
Limit number of individuals and institutions for track presentations
Don't overlap constituent group meetings with pre-conference seminars
Screen out elementary presentations
More international participation
Have vendor demos in a seminar room setting
More panel discussions
More multimedia
More real emphasis on future
Include session that focuses on professional development
More time between CAUSE and EDUCOM
Too much in 4:00 - 6:00 timeslot each day
Make all papers available at conference
Drop cost of pre-conference seminars
Spouse program
The final half day doesn't seem worth the expense
Pre-conference update workshop for Institute Alumni
Representation from national groups on standard protocols
Friday general speaker should be management related (not IT related)
Larger vendor area - more vendors
Add gopher service on CAUSENet system (or for year around use)

Speaker should repeat questions before answering
Less general sessions
Improve food - 2
Too much food

8. Do you have any tips for first-time conferees on how to get the most out of the CAUSE conference?

Read conference program early and thoroughly and plan carefully - 17
Be aggressive in introducing your self to others - 17 including
    Take advantage of social events to meet others
    Sit at tables where you don't know anyone
    Challenge yourself to find "X" new people each day for networking next year
    Seek out similar institutions and network
Go to many different types of sessions and see what you like best - 6
Don't try to attend too much - can be tiring - 4
Attend CAUSE breakfasts where services are explained and ask questions - 4
Study codes under track abstracts to attend right sessions - 3
Partner new conferee with an old-timer or mentor - 3
Attend constituent groups; they are often small with good discussions - 3
Plan for meeting colleagues and resting as well as attending sessions; pace yourself - 3
Try to focus on one or two threads of info that you want to get from the conference - 2
Talk to a previous attendee - 2
Take a pre-conference seminar to meet people in a less formal session
Tie into conference email services early
Rely on tapes for sessions missed
Don't expect every session to be perfect
Look over pre-conference program carefully
Attend sessions not related to your primary responsibilities to gain other perspectives
Attend special interest meetings
Volunteer to be a convenor
Submit proposals
If several members from your school attend, coordinate the tracks and share what each has learned
Make sure you spend time in the vendor exhibits
Take time to reflect what you have seen/heard and sift out the useful information
Volunteer for a committee
Come a day early to get a feel for the hotel and plan session attendance
Get a good night's sleep
Get up early . . . go to bed late
Come with some questions/problems for which you are seeking answers/solutions and ask everyone you talk with what they're doing in those areas
Don't miss a session - can cost you valuable information
Bring lots of business cards for contacts
Find help quickly
Talk to people about topics they seem to know about
Be prepared for a somewhat uneven pace with gaps and overlaps in schedule
Don't forget options from 3:30 - 6:00 each day. These can be some of the most valuable meetings.

9. "I would like to say ..."

Great, excellent conference - 69
Good conference - 10
Thanks to CAUSE staff and other organizers - 39
I'm leaving with ideas to implement on my return - 4
CAUSE attendees are very approachable and willing to discuss issues - 3
Connection to Internet was invaluable but more stations needed - 3

Track sessions were not as good this year - 3
Track sessions were better this year - 2
Sometimes too many things going on at the same time
Some improvement in visual materials needed
Could we have a session for people who don't know how to get on the Internet and are too embarrassed to ask?
We sure know a lot about Arizona State University. Surely there are other schools making progress or does the Board of Directors influence the track selections?
Large institutions contribute a large portion of the intellectual capital of CAUSE; they contribute a large portion of the financial capital of CAUSE; they get NO part of the governance of CAUSE; they will begin to look elsewhere for what they need.
The CAUSE policy on alcohol need reconsideration. This "prohibition" standard is archaic and newer, younger attendees may very well desire a change.

CAUSE 92

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CONFERENCE CASSETTES

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☐	TAPE 25	TRACK III - EMPOWERING USERS AS MEMBERS OF THE COMPUTER CENTER TEAM
☐	TAPE 26	TRACK IV - DEVELOPING A DATA ELEMENT DICTIONARY SYSTEM TO MANAGE THE INFORMATION ARCHITECTURE OF THE UNIVERSITY
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☐	TAPE 60	TRACK IV - IMPLEMENTING DATA ELEMENT NAMING STANDARDS
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